NOVEMBER 27, 1961

American Machinist / Metalworking Manufacturing

A McGRAW-HILL Publication • Seventy-Five Cents

Bearings are carburized in pit furnaces with forced circulation of gas — see page 1

Metal forming with ultrasonics, p83

Flame cutting by plasma arc, p93

Trepanning saves time on hole cutting, p98

THE NEW "A" BORE-MATICS

Completely new machine design from base to bridges for versatility, capacity and ease of maintenance.

by Albert A. Arbogast

Manager, Bore-Matic Machine Division
The Heald Machine Company

What is the basic philosophy behind the new "A" series line of Bore-Matics? That's a good question—and a simple one to answer because the basic motivating factor was "simplicity" itself. For in almost every case the basic new design feature in this new Bore-Matic line makes them *easier* to set up, *easier* to change over, *easier* to operate and *easier* on service inspection. All this has been accomplished while still maintaining our continual trend toward higher standards of accuracy and precision.

Take the new machine bridges, for example. Within a given size of machine, bridges are removable and interchangeable. Furthermore if a user has a single-end version of a new "A" Bore-Matic he can readily convert it to a double-end unit by adding a second bridge, boringheads, drive, and associated cycle and hydraulic equipment.

Bridge pads and tee slots are provided at both ends of all machines in each of three size ranges. Bridge setback is infinitely adjustable within its range, too—permitting wider latitude for tooling and fixture design and minimum rapid traverse time. New bridge location has also substantially increased the workholding capacity of these standard machines.

Manifold hydraulic transfer plates and valves that used to be inside the base cavity are now mounted externally on a separate panel at the rear where they are more easily accessible—such a location also isolates a heat source from the machine base contributing to uniform precision throughout longest production runs.

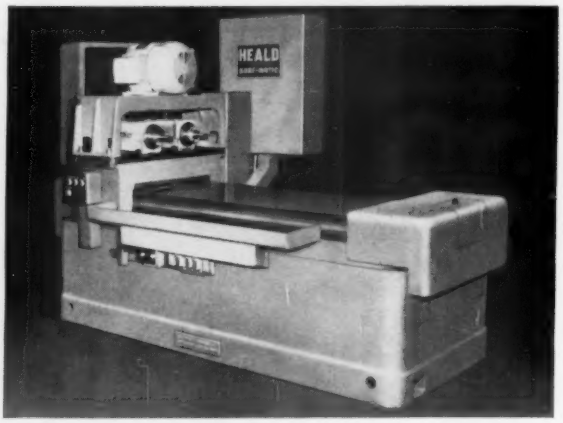
The hydraulic power unit has also been located separately from the base at the rear of the machine, for ease of access and elimination of thermal distortion.

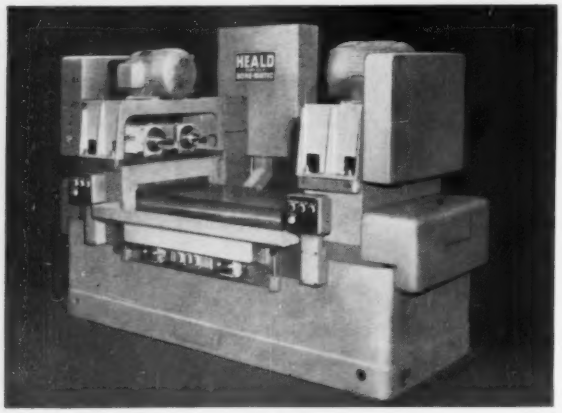
The machine table is larger, heavier and travels on hardened and ground box type ways with hold downs—such construction assures maximum accuracy of table travel.

The new model Bore-Matics are now available in three basic "A" machine sizes—2, 3 & 4—each of which can be furnished as either single or double end machines.

Capacities of the new "A" series Bore-Matics are shown in the following table:

	222A	322A	422A
Width of Bridge	31"	34"	38"
Distance between Bridges (adj.)	16"-36"	24"-43"	30"-54"
Table travel	15" or 18"	20"	25"
Table Pad Dimension	14" x 55"	18" x 64"	24" x 80"





Above, Model 424A, single end version of the size 4 type Bore-Matic; bridge, heads, drive equipment, etc. on left end only.

At left, 422A, double end version of the size 4 type Bore-Matic; bridges, heads, drive equipment, etc. on both ends of machine.

It Pays to come to Heald

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

CIRCLE 251 READER SERVICE CARD

COVER:

New "Power Convection" pit furnaces built by Surface Combustion for Tyson Bearing to speed carburizing operations. See page 90.

American Machinist / *Metalworking Manufacturing*

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TURN PAGE FOR METALWORKING REPORT——►

METALWORKING REPORT

. . . what's new and significant in manufacturing techniques and materials—direct from our own staff and round-the-world news bureaus

MANUFACTURING CONTROL . . . A computer now schedules maintenance and lubrication for some 12,000 machine tools at Pratt & Whitney Aircraft. The company feeds daily maintenance figures into the computer, which builds up machine maintenance histories and then schedules work. With this setup, P&W has **boosted machine-repair efficiency by 40%,** reduced emergency calls by 25%, increased efficiency of lube-dept workers by 35%. System was developed jointly by P&W and Mobil Oil Co.

FORMING . . . Refractory metals can be formed by slip-casting, which eliminates the problems caused in conventional melting and casting, **to a theoretical density above 90%.** Union Carbide Metals Co (New York, NY) has licked the trouble given by the high temperature properties of metals such as tungsten, tantalum, titanium, columbium, and molybdenum. A stable **suspension of metal powder in liquid is poured into a plaster mold, which absorbs the liquid.** After air drying, the "green" casting is sintered.

QUALITY CONTROL . . . Bearings for critical applications are virtually certain not to fail from metal fatigue, over some minimum life span. In describing this "safety zone," Tibor Tallian, SKF's lab manager, stressed that **this 'guaranteed" life is low**—only about 4% of the bearing's 10% life (that time in which no more than 10% of a group of bearings would be expected to fail). Most important, the SKF **tests show that there is some time interval during which bearings will not fail from fatigue.** This finding, precipitated by reliability requirements, could figure in space applications.

FORMING . . . Pressure boosters, fixed to the rams of mechanical presses, let the die exert more controlled pressure in holding and forming the blank. The attachments, called Hydro-Die boosters by Di-Dro Engineering, Inc (Detroit), are self-contained hydraulic systems. During the press stroke, **accumulated pressure is cushioned to give a constant die pad hold-down action,** as metered by a knob adjustment.

JOINING . . . Heat and pressure increase the speed and effectiveness of solid-state bonding according to a report from Battelle Memorial Institute. For example, stainless honycomb and skin can be **joined without braze metal in three hours at 2100 F** (with a pressure of 10,000 psi in an inert-gas-filled cold-wall autoclave). Parts are sealed in a pressure-tight evacuated envelope where **inert gas—at 10,000 psi—bears against envelope to hold parts in contact.** Advantages of solid-state bonding: No cast structure, service temperature higher than brazed joints, can join very brittle metals.

PLATING . . . Anode baskets made of commercially pure, perforated sheet titanium hold ball anodes for nickel plating at Univertical Corp (Detroit). Reason: Titanium will pass current to anodes it contacts, but will not pass current directly to bath. Baskets, which **do not corrode in plating baths, should last 10 years** in continuous use.

WELDING . . . Titanium-to-titanium welding can be done outside a purged chamber with inert gas shielding on both sides of the joint, according to Crucible Steel Co engineers. Careful pre-weld cleaning, plus some fixturing to obtain the two-sided shielding, gives **as-welded joints with mechanical properties equal to annealed base metal.** Reports on this technique—which can put titanium welding in the same class of complexity as welding of stainless—will appear in a forthcoming issue.

MATERIALS HANDLING . . . With a remote-control device, cranes can now be operated from the plant floor. A transmitter, no larger than a cigar box, attaches to operator by shoulder straps (which carry the antenna) and a waist band. Signals from operator are received in crane cab and converted into **commands that operate existing controllers to start, reverse, or accelerate the motor.** Developer is Barrett Electronics Corp.

CUTTING . . . Side clamping feature on the new AGT-85 profile turning tool (see cut) **prevents inserts from shifting under widely varying tool forces.** Designed by Monarch Machine Tool Co for **heavy-duty profile turning of even the toughest alloys,** the tool has a 1⅛ by 1¼-in. shank. Inserts, which have four cutting edges with a 5° negative rake, are 3/16 in. thick and **present ¾ in. of carbide along the cutting edge.**

ARC CUTTING . . . Plasma arc torches can cut stainless steel up to 4 inches thick and 5-in. aluminum slabs. A New Jersey steel center is even fabricating intricate configurations to customer order from 4-in. stainless. When cut by Plasmarc (see story, page 93) **stainless requires no edge preparation or machining before welding.**

FLAME CUTTING . . . MAPP, a new industrial gas, gives operating economies of 15 to 45% according to The Dow Chemical Co. The stabilized methylacetylene, which can be liquefied and handled in regular LPG equipment, is as **safe as propane, but cuts faster.** The gas, which is said to be **safer to use than acetylene, costs less.** Particular recommendations: powder cutting of stainless, cutting mild steel, metalizing, brazing, heating.

HEAT TREATING . . . A continuous, conveyorized vacuum furnace designed by C I Hayes Co (Cranston, RI) is being used to alloy diodes at General Instrument Corp (Newark, NJ). **Except for loading and unloading, the entire operation is automatic.** Operator loads diodes into boats which progress from loading table, through the vacuum lock, through multiple heat zones **(temperatures up to 1000 C are maintained within ±1 C)**, into the cooling zone, and then are ejected through an exit vacuum lock.

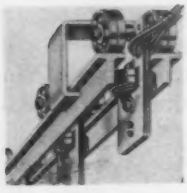
Continued on next page

Coming in AM/MM

- *A quality-control plan for screw machine work*
- *Magnetic chucks for planing*
- *Tractor builder aims for flexibility*

METALWORKING REPORT . . .

FINISHING . . . Twenty-four seconds is a mighty short time for curing industrial enamels that ordinarily take 30 minutes. But this is claimed for Pittsburgh Plate Glass Co's Duracon coating and special heating equipment soon to be available. The equipment **converts gaseous fuel directly into "far" infrared radiation**—the most efficient infrared energy—which cures the coating surface exposed to it without bringing the base metal up to curing temperature. Because the enamel is a thermosetting acrylic polymer, the **radiation does not harm it during curing.**



MATERIALS HANDLING . . . A double T-bar track substitutes for the conventional I-beam in a new overhead conveyor design (shown). Each trolley has three wheels—two vertical and one horizontal—that roll on the track formed by T-bars. This design **eliminates the need for outside guide rollers and similar devices.** Installation costs? "Far below" those for I-beam types, says the maker, Hapman Corp.

HEAT TREATING . . . A punch-card system that controls all heat-treating variables has been developed by Lindberg Engineering Co. Metallurgical department punches instructions (such as times, temperatures, dewpoint, type of quench) into a **standard card that also serves as a job ticket.** See page 121 for full details.

FORMING . . . One man tends six valve upsetting installations in German Opel and Ford plants equipped with automatic units from Ottensener Eisenwerke. After cut lengths of bar stock are **fed alternately into two induction-heating and first-stage upsetters on either** side of a main forging machine, bar ends are heated and upset to a pear shape. These are **fed alternately to the main unit** which finish forms valve heads.

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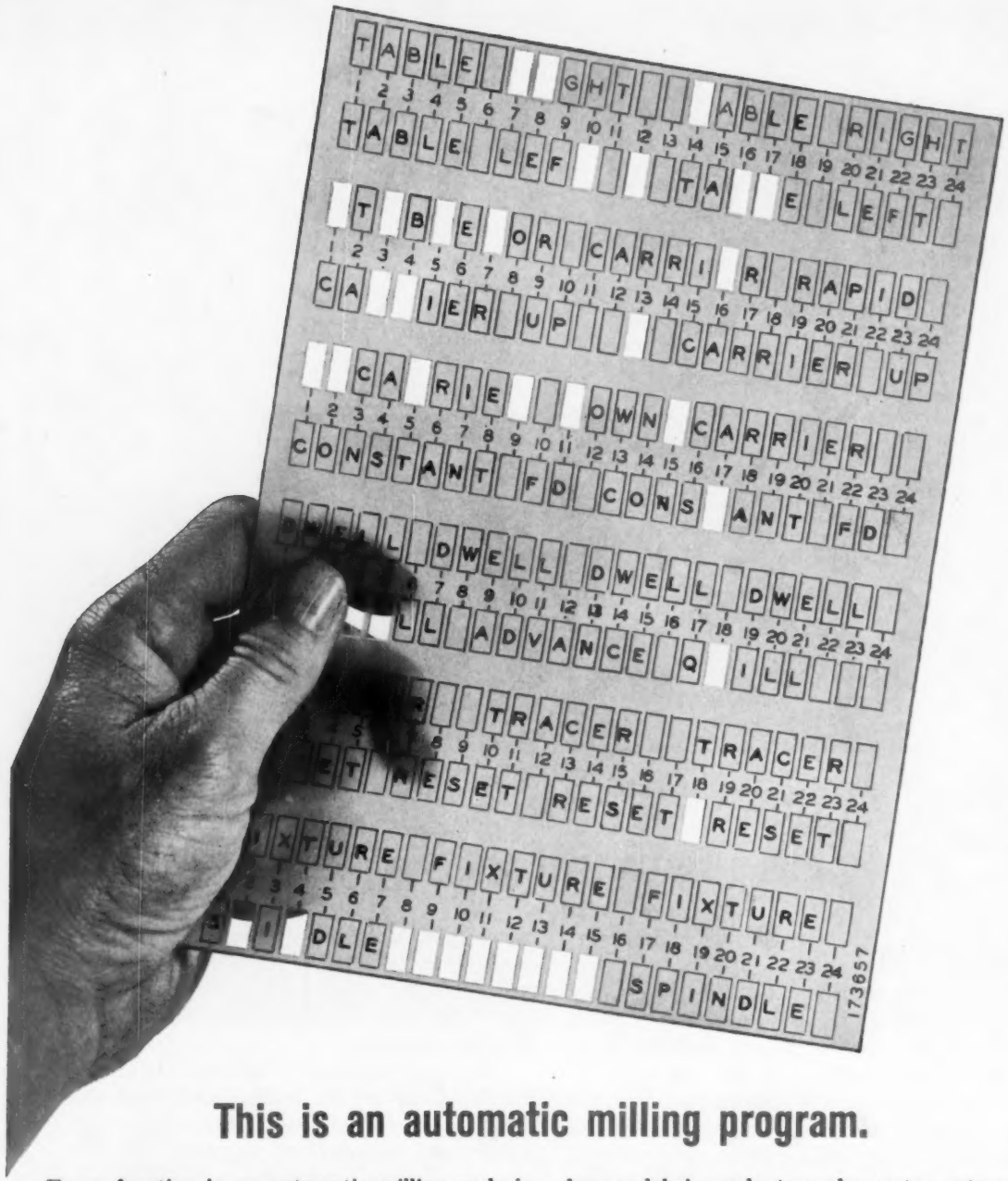

This is an automatic milling program.

Every function in an automatic milling cycle is established by this template. It fits the peg board of Telematic Control, the "brains" of CINCINNATI rise-and-fall HyPowermatics (200 Series).

The operator will simply place plugs at the positions indicated on the template, orient table and carrier trip dogs and he's ready to make parts—automatically!

Telematic provides a practical and low cost method of directing the tool path for thousands of milling jobs. We think it's the best answer to high production, automatic milling without sacrificing flexibility. Please turn to the next two pages for the complete story. Milling Machine Division, The Cincinnati Milling Machine Company, Cincinnati 9, Ohio.

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KNEE TYPE AND BED TYPE MILLING MACHINES • DIE SINKING MACHINES
• CUTTER AND TOOL GRINDERS • ELECTRICAL MACHINING EQUIPMENT

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MILLING MACHINE DIVISION

He's setting up a milling job.

Each plug pegged into this Telematic control panel determines an event in a milling cycle.

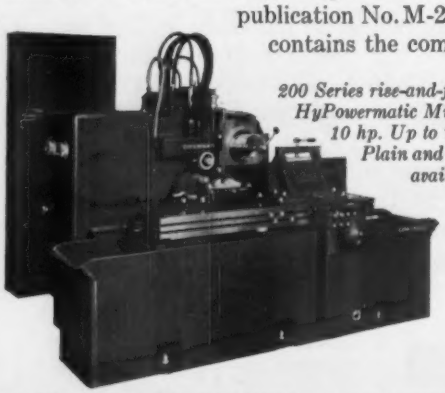
When all the plugs are placed, the operator will have set up a complete automatic cycle—in minutes. Tomorrow—or next month—he can reset the plugs for an entirely different job.

Functions controlled and coordinated by Telematic are these: Table feed right or left. Spindle carrier feed up or down. Table or carrier rapid traverse. Constant feed (slow feed for precision positioning). Dwell. Quill advance (or retract). Tracer. Fixture (clamp or index). Spindle.

Up to 24 separate events can be programmed on the standard panel. Events are initiated by trip dogs on the table and spindle carrier.

Literally thousands of cycles are possible, including complex multiple-operation work requiring successive cuts to different depths. Tolerances can be held to ± .001". For cycles intended to be repeated from time to time, templates are provided to speed up plug positioning.

Telematic Control was developed to program our 200 Series rise-and-fall HyPowermatics. It gives you the advantages of automatic milling plus versatility at a fraction of the cost of other systems. Ask us to send publication No. M-2020-2 which contains the complete story.



200 Series rise-and-fall HyPowermatic Milling Machine. 10 hp. Up to 72" table travel. Plain and duplex styles available.

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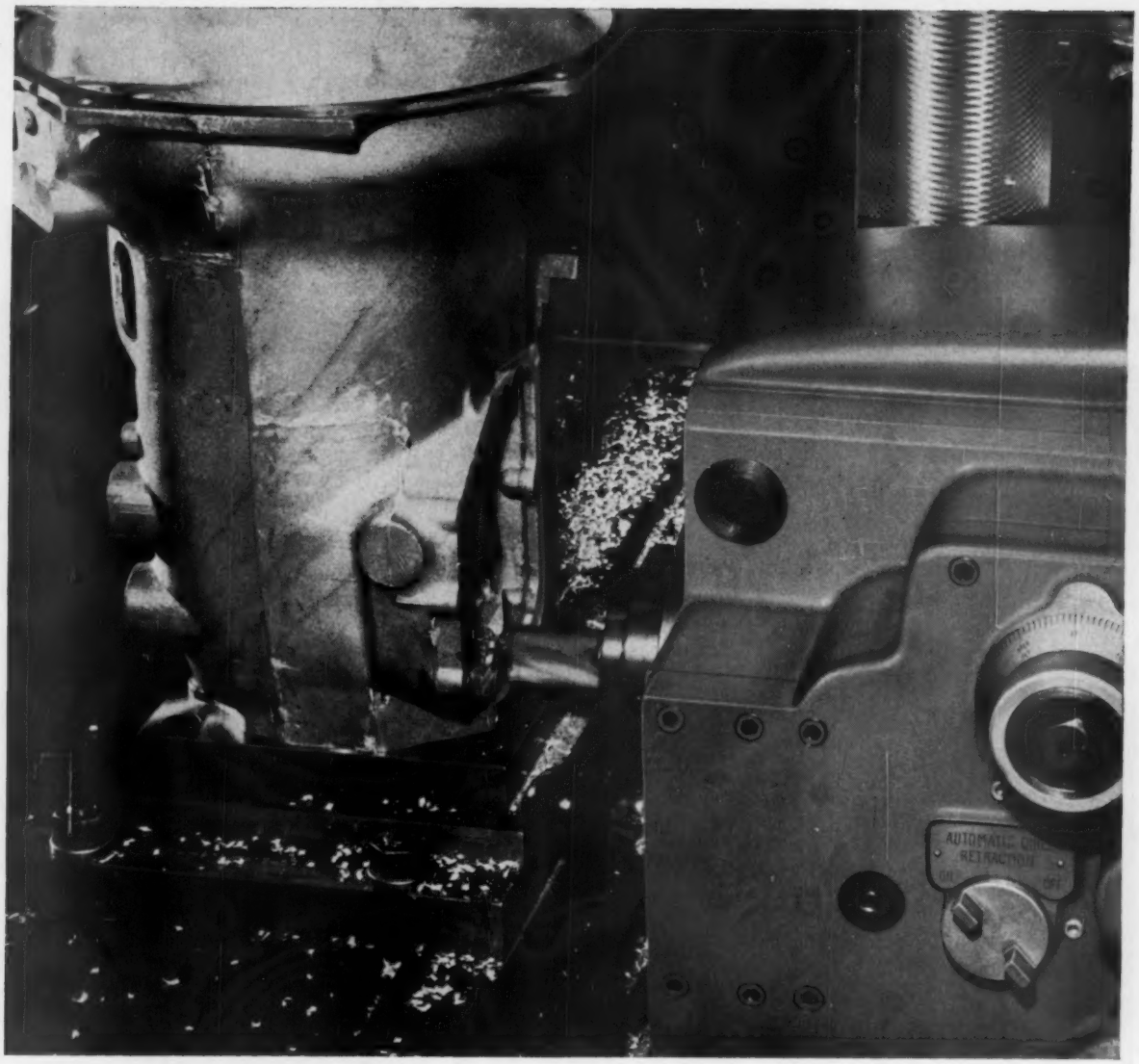
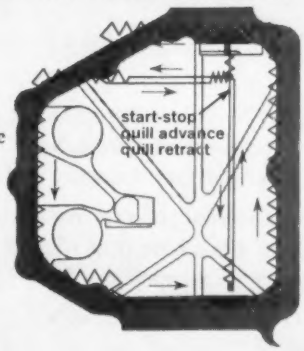


See what you can do with Telematic Control

Part: Gear case.
Material: Aluminum
Operation: Mill cover face and two scallops.
Machine: CINCINNATI HyPowermatic equipped with Telematic Control.
RPM: 2000
Feed: 19″/min.
Depth of cut: ⅛″
Time per piece: 2.47 min.



Cycle: 1. Carrier rapid down. Quill advanced. 2. Carrier feed down. (Dwell) 3. Carrier rapid up. 4. Carrier feed up. (Dwell) 5. Carrier rapid down. 6. Quill retract. 7. Table rapid right. 8. Table feed right. 9. Carrier feed down. 10. Table feed left. 11. Carrier feed down. 12. Table feed left. 13. Carrier feed up. 14. Table feed right. 15. Carrier feed down. 16. Table rapid left. 17. Table constant feed left. 18. Quill advance. 19. Reset. Ready for next cycle.

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MILLING MACHINE DIVISION

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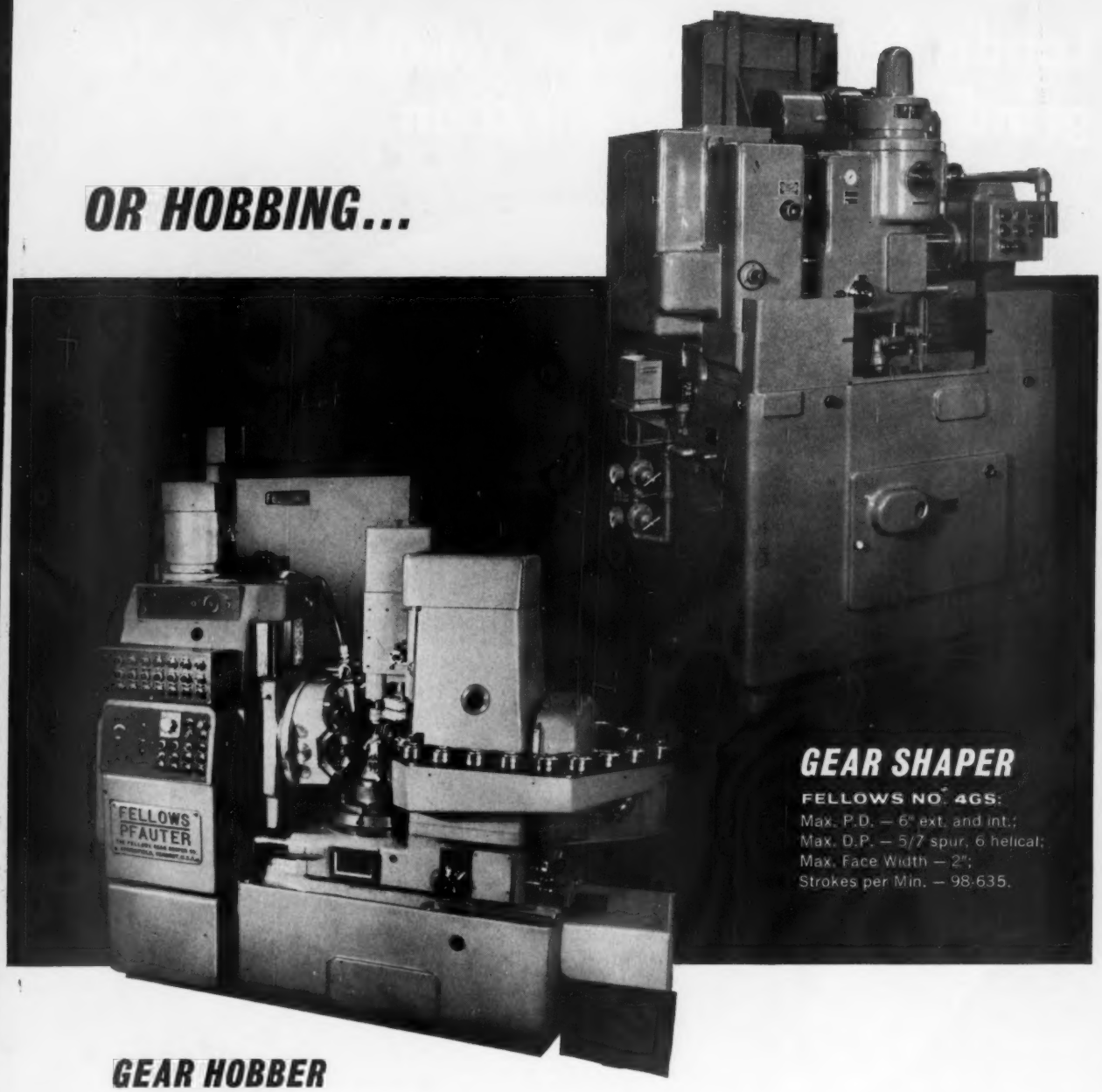

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Max. P.D. — 6" ext. and int.;
Max. D.P. — 5/7 spur, 6 helical;
Max. Face Width — 2";
Strokes per Min. — 98-635.

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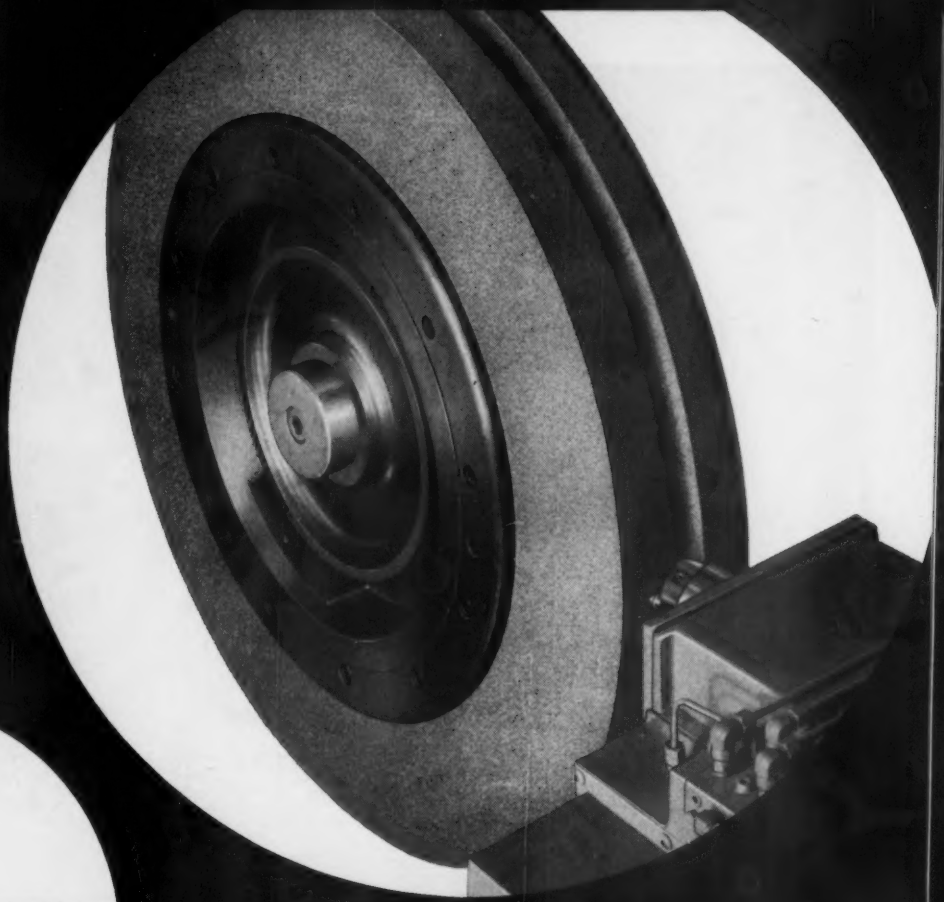

Work support. Exclusive wedge work rest and loaded ball spindle footstock give maximum rigidity to work parts.

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Wheel support. Exclusive Microsphere wheel spindle bearing reduces sparkout time, speeds production.

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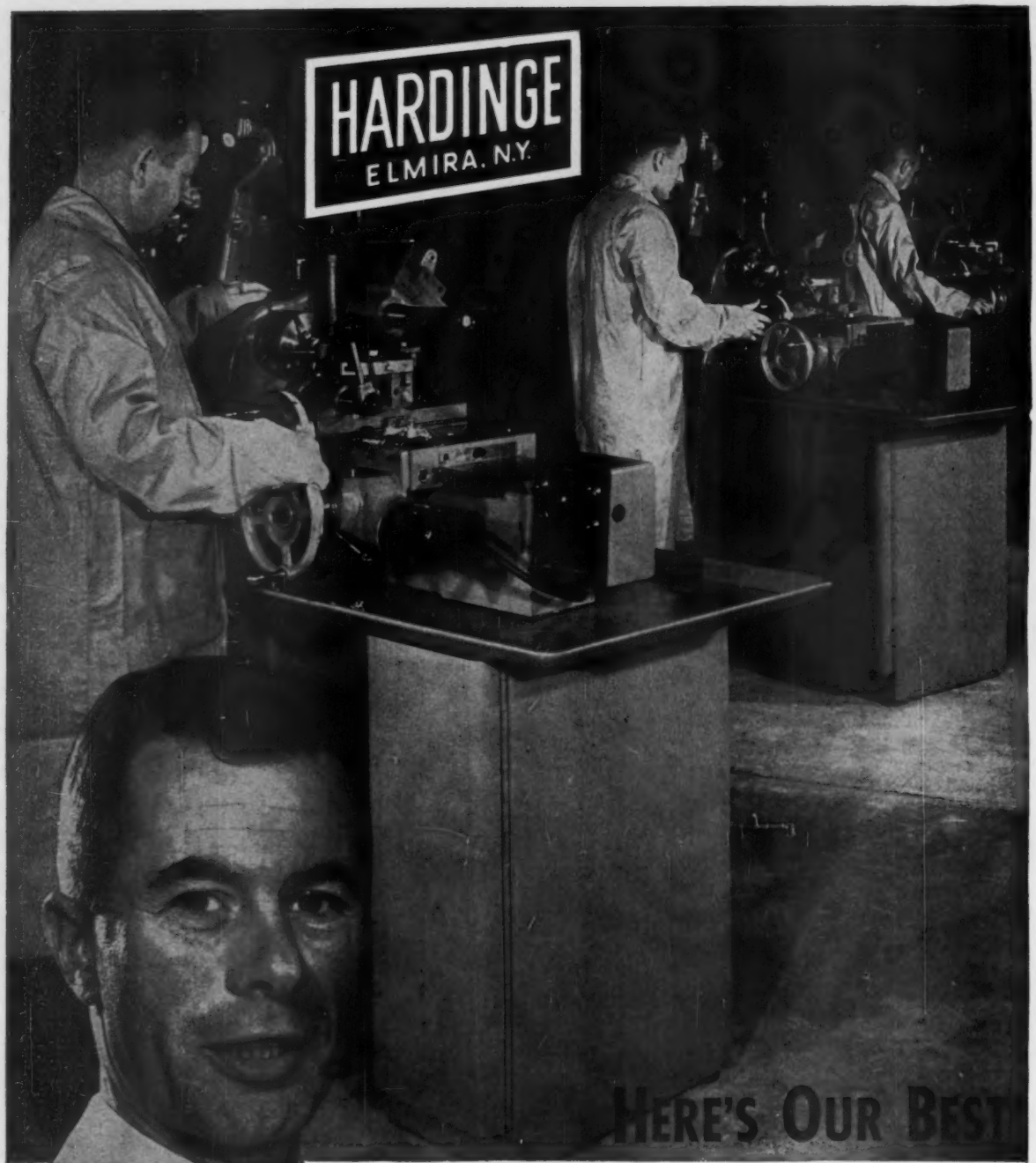

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more parts per disc **lower unit costs**

production data

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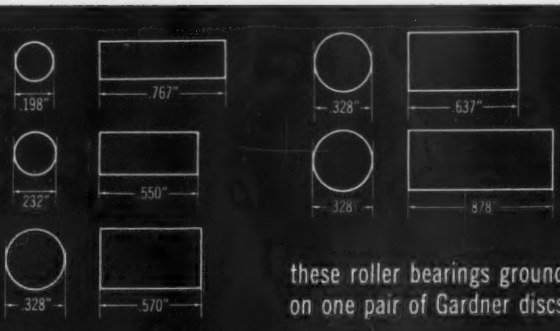
machine . . Gardner 2H20 Double Spindle Precision Disc Grinder
production . . . . . 9,350 parts per hour
stock removal . . . . . .017"-.020"
flatness . . . . . .0002"
parallelism . . . . . .0002" or less
uniformity . . . . . .0005"
squareness . . . . . .0002" or less
finish . . . . . 10-15 RMS

Check with your Gardner Abrasive Specialist to see how performance like this can lower your disc grinding costs.



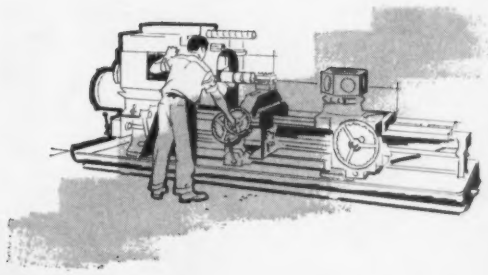
these roller bearings ground on one pair of Gardner discs

GARDNER

GARDNER MACHINE COMPANY, BELOIT, WISCONSIN

The job illustrated is typical of work where large amounts of metal are removed. For example, one forging was reduced from 1850 lbs. as forged to 890 lbs. after machining. Material AISI-1045. Floor-to-floor time: 5¼ hours including setup and gaging.

AT CANN & SAUL STEEL COMPANY
Royersford, Pa.



80 lbs. of metal turned from this forging in 3 minutes

Warner & Swasey 36″ swing 5-A in progressive forge shop cuts metal full time at maximum rates yet provides fast handling for small lot production.

The 5-A turret lathe has the power and the rigidity to hog metal at this clip yet the same machine finishes work to .002″ or less for Cann & Saul. Heavy metal removal plus the ability to handle one to four-piece lots at low cost on a battery of Warner & Swasey's are but two reasons why Cann & Saul remains a leader in the competitive custom machined forging field. They make good use of the power built into the 5-A Extra Heavy Duty Warner & Swasey turret lathe by taking cuts up to 1″ deep at 300 SFPM and .025″ feed. The machine's 36″ swing and 12½″ hole through the spindle accommodates a wide variety of forging shapes.

Rough forgings machined by the Cann & Saul Company include medium carbon steels, stainless, titanium and other alloys, and frequently are heat treated to 300 Brinell before machining. Eccentric and interrupted cuts are a stiff test of machine rigidity.

The hydraulic speed shifts and easy handling tool carriages help the operator to handle small lots efficiently . . . and the work is within easy reach for rapid gaging, an extremely important factor on a big machine like the 5-A.

For more information contact your resident Warner & Swasey Field Engineer, or Warner & Swasey Company, Cleveland 3, Ohio.

YOU CAN TURN IT BETTER, FASTER,
FOR LESS...WITH A WARNER & SWASEY

WARNER & SWASEY

CIRCLE 264 READER SERVICE CARD

"Bob, the computer analysis says we should buy those parts instead of making them"

NEW CAPITAL INVESTMENT PROGRAM

Here's a new IBM computer program that's yours for the asking. Using the Investors Method (Rate of Return on Investment), it helps you evaluate—*quickly, economically, uniformly*—alternate proposals for spending your company's money.

The program will help you solve problems like these: should you buy a new piece of equipment or keep the old one in repair; should you increase your manufacturing facilities; should you buy or make certain products; how should you spend your money for research to make the most profit?

These are only a few of the problems that the Capital Investment Program handles. All it takes is the Program and an IBM computer that accepts FORTRAN programming language. The low cost IBM 1620 Data Processing System is one such computer.

The new Capital Investment Program is another of the many problem solving programs IBM offers you to help make your data processing system a more effective and more profitable tool for managing your business.

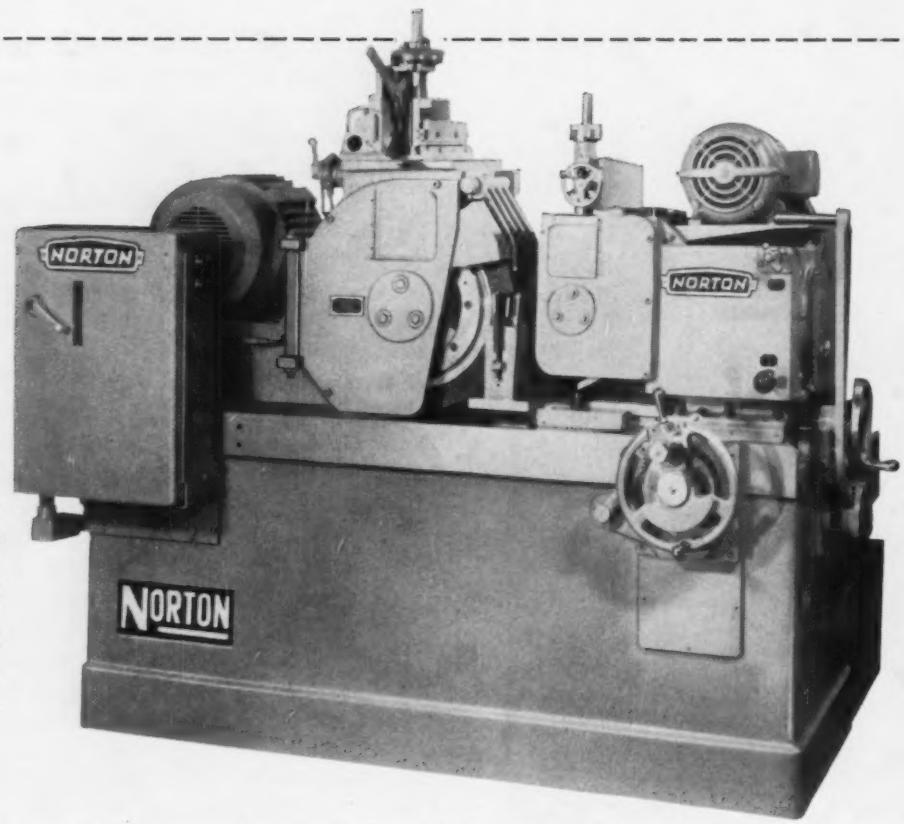
Your local IBM Representative can give you complete details on this, as well as previously announced programs, which included Sales Forecasting, Materials Planning, Inventory Management, Plant Scheduling, Work Dispatching, Operations Evaluation, Inventory Management Simulation, and many others.

IBM®
DATA PROCESSING

CIRCLE 266 READER SERVICE CARD

SOLID SUPPORT for the "Touch of Gold"

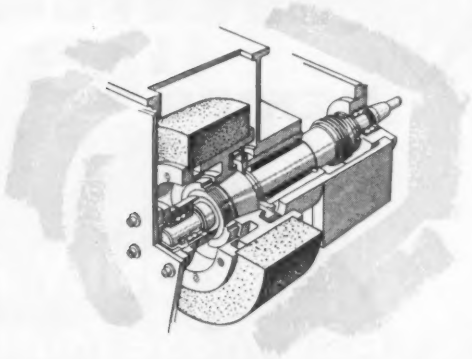
The Norton No. 2 Straddle-Bearing Centerless Grinder is built for productivity...



The new Norton No. 2 Centerless Grinder can be arranged for full automatic, semi-automatic or manual thru-feed or plunge grinding. Capacity includes work diameters ranging from 1/16" to 4 3/4" depending on type of work rest and bar grinding fixture.

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

3 MAJOR ADVANCEMENTS IN CENTERLESS GRINDING



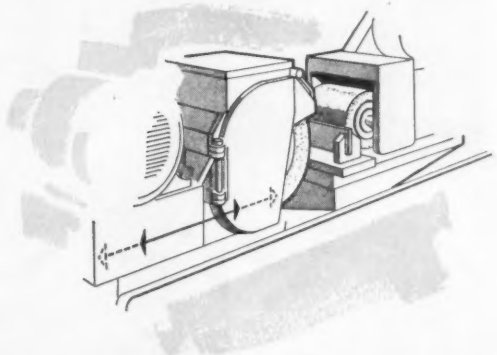
accuracy . . . economy

Straddle-Bearing Spindle Support, in both grinding and regulating wheels, provides extra strength. Combined with the inherent rigidity of Norton spindles this boosts capacity to take heaviest cutting pressures, while permitting fast grinding to close tolerances under all conditions.

Like all Norton grinders and lappers the Norton No. 2 *Straddle-Bearing* Centerless Grinder is built to deliver "Touch of Gold" performance — the Norton extra that adds value to your product while cutting your production costs.

You'll find plenty of proof of that in the modern construction of this newest machine of its type. *Straddle* support of spindle bearings adds strength and ability to take tough jobs . . . the mobile wheel head and constant work-loading alignment make jobs shorter and easier.

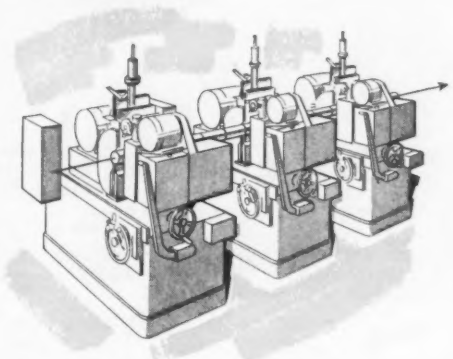
Many other features result in outstanding performance advantages. Call your Norton Sales Engineer, a trained expert in the grinding field, for consultation on how these features can benefit your production. Or write for Catalog 1328. NORTON COMPANY, Machine Division, Worcester 6, Mass.



Mobile Grinding Wheel Head, with wheel mounted between head ways and feed screw located beneath wheel center for ideal balance, provides instant response to signals. This results in especially fast sizing, one of many important advantages over fixed head operation.

NORTON
MACHINE TOOLS

District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit.
In Canada: J. H. Ryder Machinery Co. Ltd., Toronto 18



Work Loading Alignment is never disturbed by wear of either grinding or regulating wheel . . . neither is the alignment of the work rest blade. Movable heads for both grinding and regulating wheels make this advantage possible . . . and especially time-saving in a battery set-up.

Making better products . . . to make your products better

MACHINE TOOL DIVISION: Grinding and Lapping Machines — G & E DIVISION: Shapers • Gear Cutting Machines

New ARMSTRONG "90" SERIES RATCHET

The ONLY Ratchet with ALL these important features!

1. Slenderized head
2. Thumb-operated reversing lever specially designed so it won't come off
3. Reversing-lever stop (Ball-and-spring prevents accidental shifting)
4. Simple to clean—only tool required is a Phillips screwdriver (wearable parts may be individually replaced)
5. Thin handle with knurled grip
6. Hole in handle for convenient hanging
7. Fine-toothed gear
8. Easy ratcheting action
9. ¼", ⅜", and ½" square drives (two handle lengths in ½" drive)

All wearable parts of ARMSTRONG Ratchets can be replaced individually, inexpensively, and easily. Entire ratchet handles need not be replaced in the event of tooth wear, as is necessary with ratchets in which the teeth are formed in the head of the handle.

* The name ARMSTRONG on these fine tools is your assurance of highest quality. Manufactured under strict quality control, all ARMSTRONG Tools can be used with confidence.

Extra heavy duty "50" Series ARMSTRONG ratchets (illustrated at right) are manufactured in 1", ¾", ½", and ⅜" square drive sizes. For complete information on these, as well as the approximately 5500 other tools in the ARMSTRONG Line, see General Catalog #700. Your local ARMSTRONG Distributor can supply you with Catalog #700 and can show you the new "90" Series Ratchets. If you do not know who handles the ARMSTRONG Line in your area, we will be glad to furnish this information upon your request.

EXTRA HEAVY DUTY RATCHETS

SOCKETS

WRENCHES

WRENCH SETS

Buy ARMSTRONG TOOLS from your Industrial Distributor

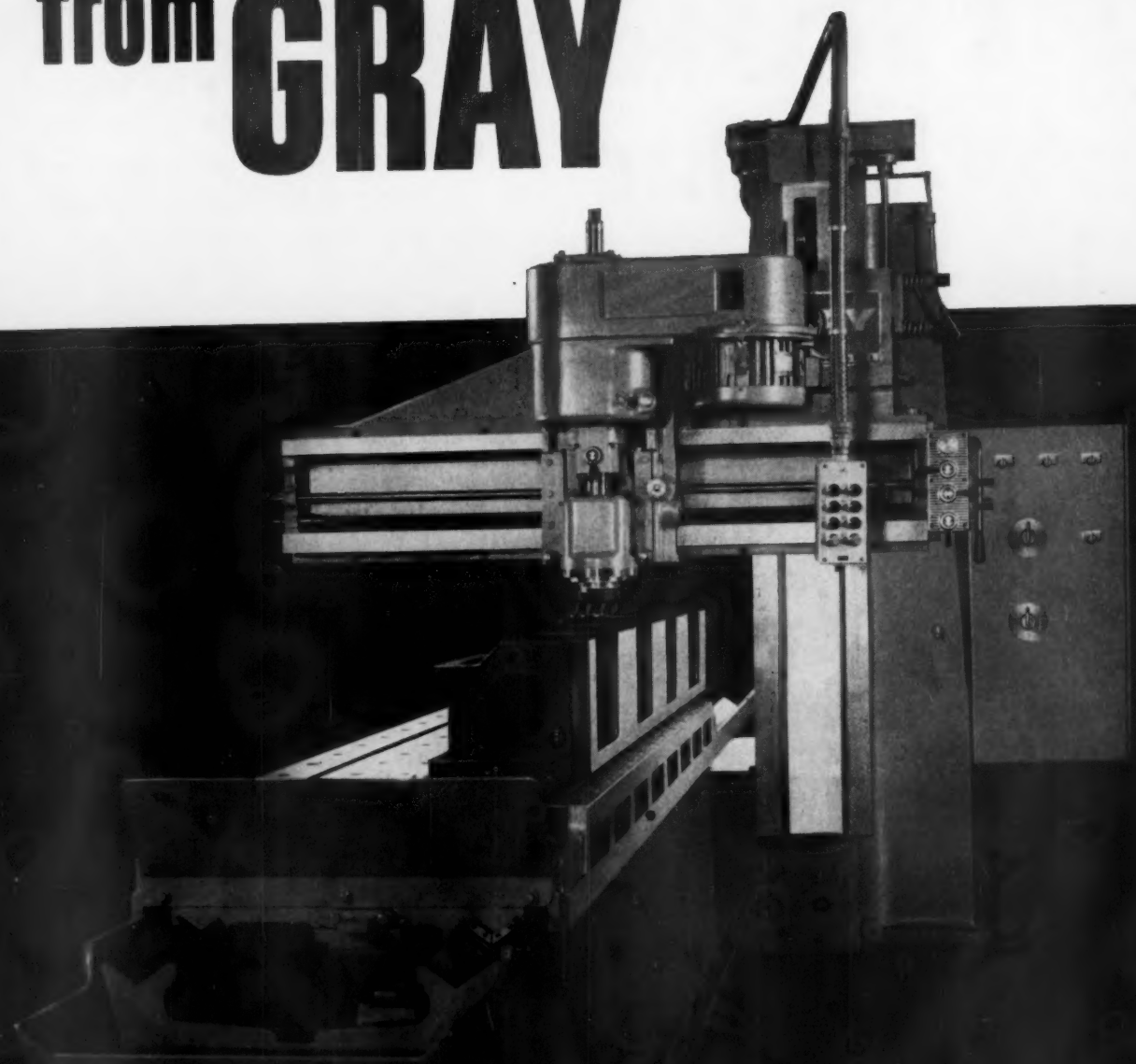
ARMSTRONG BROS. TOOL CO.

5215 W. ARMSTRONG AVE. • CHICAGO 46, ILLINOIS

CIRCLE 269 READER SERVICE CARD

CIRCLE 270 READER SERVICE CARD ►

NEW budget class miller from GRAY

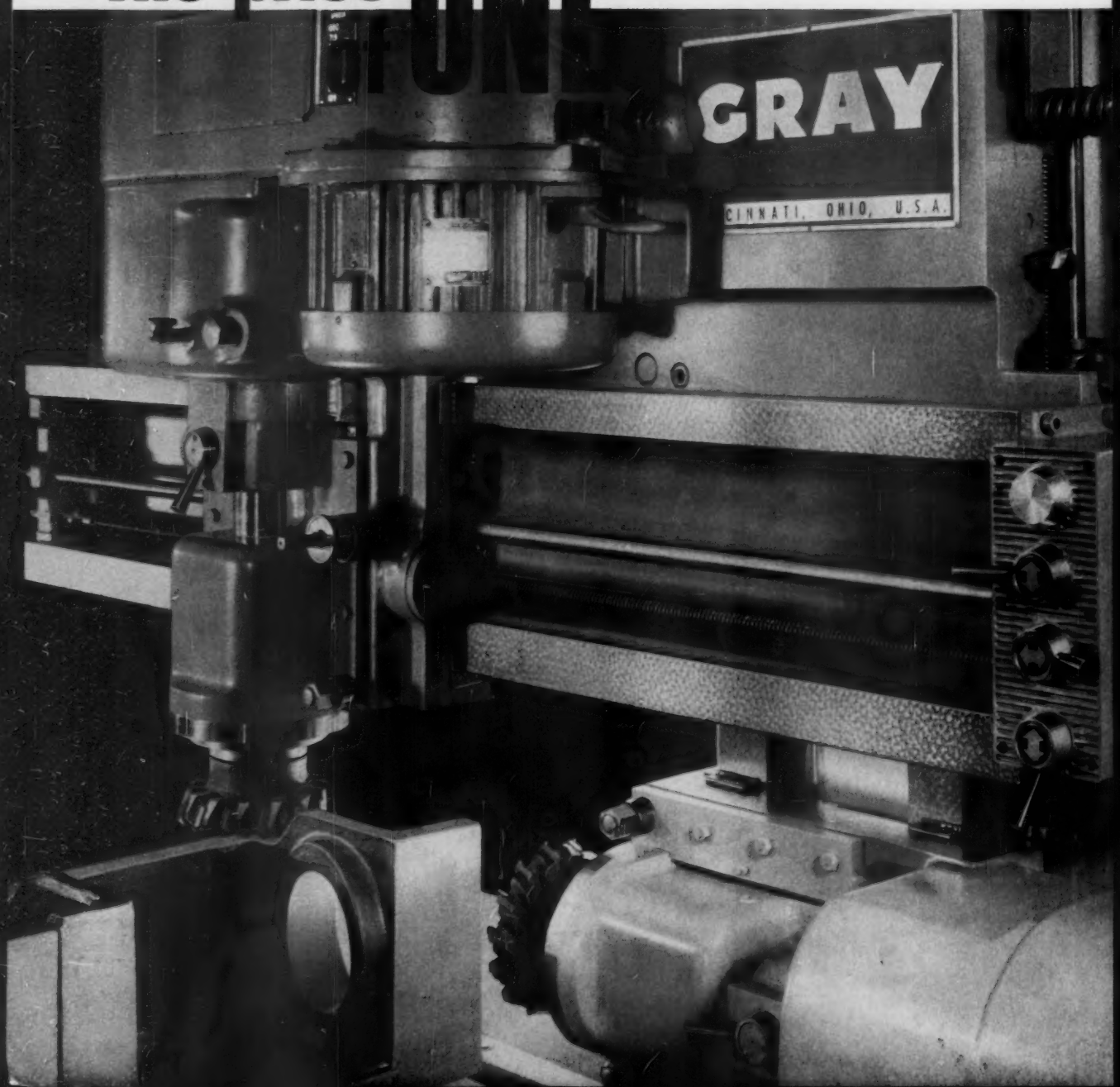


$33,700.00

ONE RAIL HEAD
30" X 6' TABLE

TWO heads for less than the price ONE

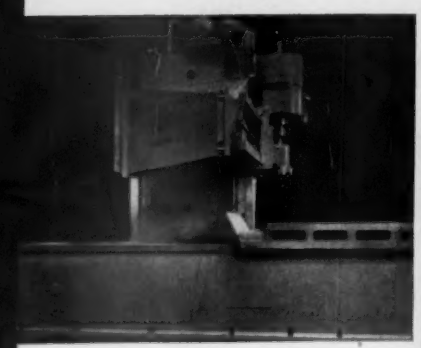
Most milling machines built with one spindle, cost more than the new Gray Handymill equipped with two spindles. Why ever consider high priced single spindle machines with fancy controls you don't need, when you can enjoy the low priced, versatile Gray.

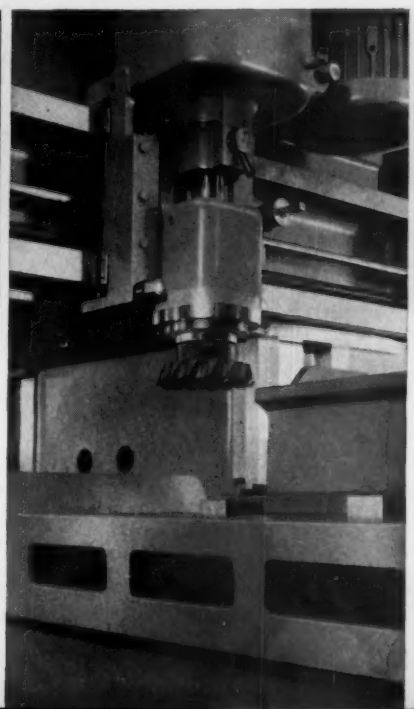


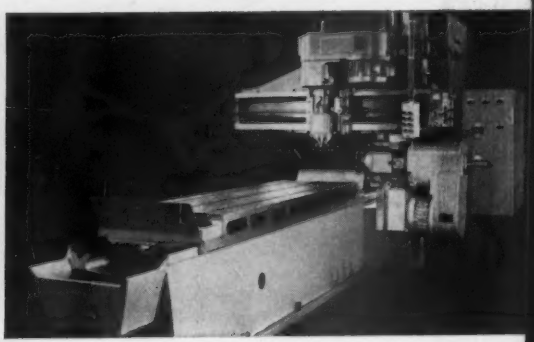
CHIPS fly at the rate of 4½ lbs. per minute

An outstanding performance, proof positive that the Gray Handymill has power to spare. Maximum chip removal, versatility, low burden factor minimum maintenance, all at the fabulously low price of $33,700—(basic machine, one head) makes the Gray Handymill your best investment.

SOLID GRAY CONSTRUCTION THROUGHOUT







Technical Bulletin No. 77R Available

THE G. A. GRAY CO.

CINCINNATI 7, OHIO

MILLING MACHINES-PLANER TYPE/MILLING PLANERS/PLANERS/ HORIZONTAL MILLING, BORING AND DRILLING MACHINES

CIRCLE 272 READER SERVICE CARD

GRAY Flying Scot above is 42" x 28'
with two rail heads
and special duplex table.

26 page Bulletin No. 73
on GRAY Flying Scot
available
on request

The G. A. Gray Co. / Cincinnati / Ohio /

What makes the $30,660* GRAY a best seller?

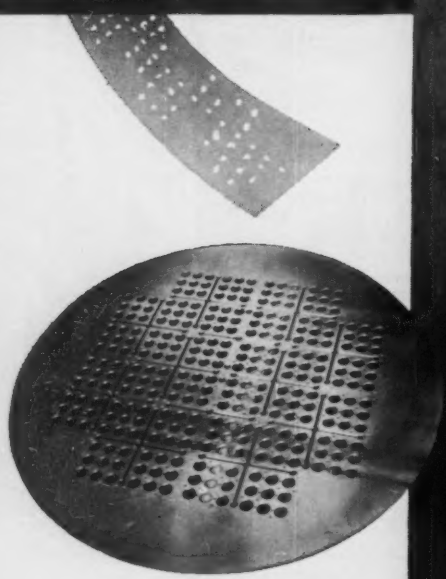
The 30"—36"—42" GRAY Flying Scot can lick any planer its size, in price or performance. It packs more value per dollar than any planer ever built. It is perfectly constructed, down to the smallest component, exactly like every Gray machine. It will perform — precisely — for years. Carbide planing up to 300 ft. per minute makes it the world's highest production small planer. Optional features, like double cutting and a duplex table, increase its productivity — and your hourly profit. Over (48) have been purchased since first introduced in May 1960.

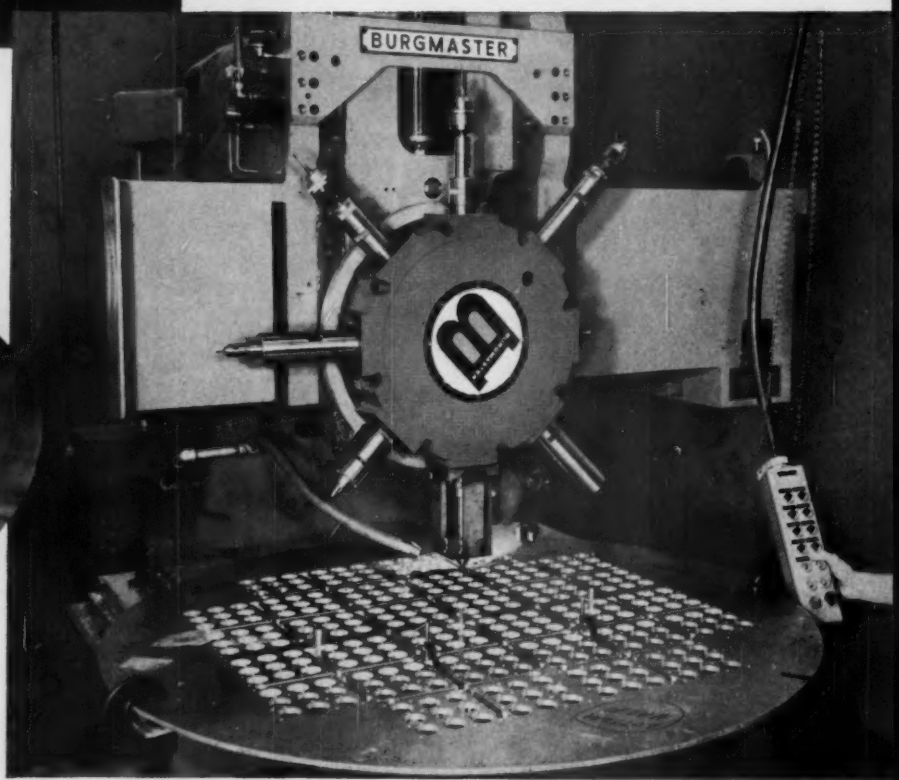
*Basic price of 30" x 6' Flying Scot one rail head, electric drive, and controls.

horizontal milling and boring machines / planers / milling planers

GENERAL ELECTRIC USES Burgmaster TAPE

- **Production Speeded from 8 Weeks to 9 Days**
- **Saves 60 Hours of Lead Time**
- **$800.00 Fixture Eliminated**

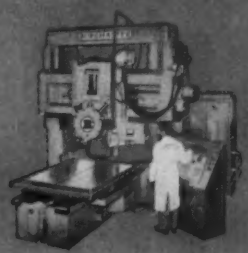




Burgmaster Model 3BHT 8-spindle, 1½" capacity in steel. Table travel 20x30, 30x45.

Model 25AHT 6-spindle, 1¼" capacity in steel. Table travel 15x26, 20x30, 30x45.

Model 2BHT 6 spindle, ¾" capacity in steel. Table travel 10x18, 15x26, 20x30



Model 3BHT-B Double Housing Planer Type 8-spindle, 1½" capacity in steel. Table travel 48x60.

◀ CIRCLE 274 READER SERVICE CARD

CONTROLLED TURRET DRILLS

TO PROGRAM 2,098 OPERATIONS EACH PART

(General Electric Company, Atomic Power Equipment Dept., San Jose, Calif.)

● *Tape-Controlled milling operations* are now added to the versatility of the Burgmaster Model 3BHT, 8-spindle tape-controlled Turret Drills. At General Electric's San Jose facility, 10 slots .176" wide and 3½" long, and 24 slots ⅜" wide and 10" long are milled in a 6061-TC aluminum nuclear reactor grid plate ⅜" thick. These milling cuts are rough and finish, both sides, and are all programmed in tape. 1962 additional center drill, drill, bore, ream and tap operations necessary to complete each unit are also programmed in tape and performed by the Burgmaster Model 3BHT with push-button control. All holes are held to .004" true position over entire area. In this operation, production has been speeded from 8 weeks to 9 days, 60 hours of lead time have been saved and an $800.00 fixture eliminated.

JOB FACTS

Company: General Electric, Atomic Power Equipment Department, San Jose, California.

Machine: Burgmaster Model 3BHT—"GENERAL ELECTRIC MARK II" Tape-Controlled Turret Milling, Drilling, Tapping and Boring Machine.

Part: Nuclear Reactor Grid Plate, ⅜" x 55½" diameter.

Special Attachments: Milling, Reciprocating Drilling, 3-Dimensional.

Lot Size: 2

Tolerance: .004" of True Position Over Entire Area.

Holding: 2 Pins on Sub Plate, Simple Clamps.

Machine Operations: Total 2,098 Machine Operations.
288 holes—center drill, drill, bore and ream (4)
384 holes—drill (1)
128 holes—drill and tap (2)
60 holes—drill and bore (2)
50 holes—drill (1)
10 slots—mill, rough and finish both sides (4)
24 slots—mill, rough and finish both sides (4)

Former Method: Individual Milling and Drilling Machines with Drill Fixtures.

Present Method: All operations programmed in tape for Burgmaster Model 3BHT.

Savings: 31 Days, 60 hours lead time, $800.00 fixture.

Other Advantages: Greater Accuracy, Less Cost. No Scrap Loss, Eliminates Operator Fatigue.

CIRCLE 276 READER SERVICE CARD

Send for Literature

Write for bulletin describing Burgmaster 6 and 8 Spindle Tape Controlled Turret Drilling, Tapping and Boring Machines. Forty minute 16 mm sound film showing all Burgmaster Turret Drills in operation is available without charge from any office.

Burgmaster CORPORATION

15001 S. Figueroa Street • Gardena, California • FAculty 1-3510 DAvis 9-4158

BURGMASTER DIRECT SALES OFFICES: Ridgewood, New Jersey, 86 North Maple Avenue., GIlbert 4-3002 • Chicago 5, Illinois, 4908 Lincoln Ave., LOng Beach 1-1178 • Cleveland 7, Ohio, 14706 Detroit Ave., ACademy 6-7030 • Detroit 37, Michigan, 13730 W. Eight Mile Road, Lincoln 8-4333 • Northern California, Castro Valley, JEfferson 7-1650 • Kearney & Trecker, C.V.A. Ltd., Sole Agents for Great Britain, British Commonwealth and Western Europe.

World's Largest Builder of Turret Drilling Machines

"O" Manual Power Index ¼" Capacity

1C Manual Power Index ⅜" Capacity

2B Manual Power Index ¾" Capacity

2BR Ram Type Radial Drill ¾" Capacity

2BH Automatic Hydraulic ¾" Capacity

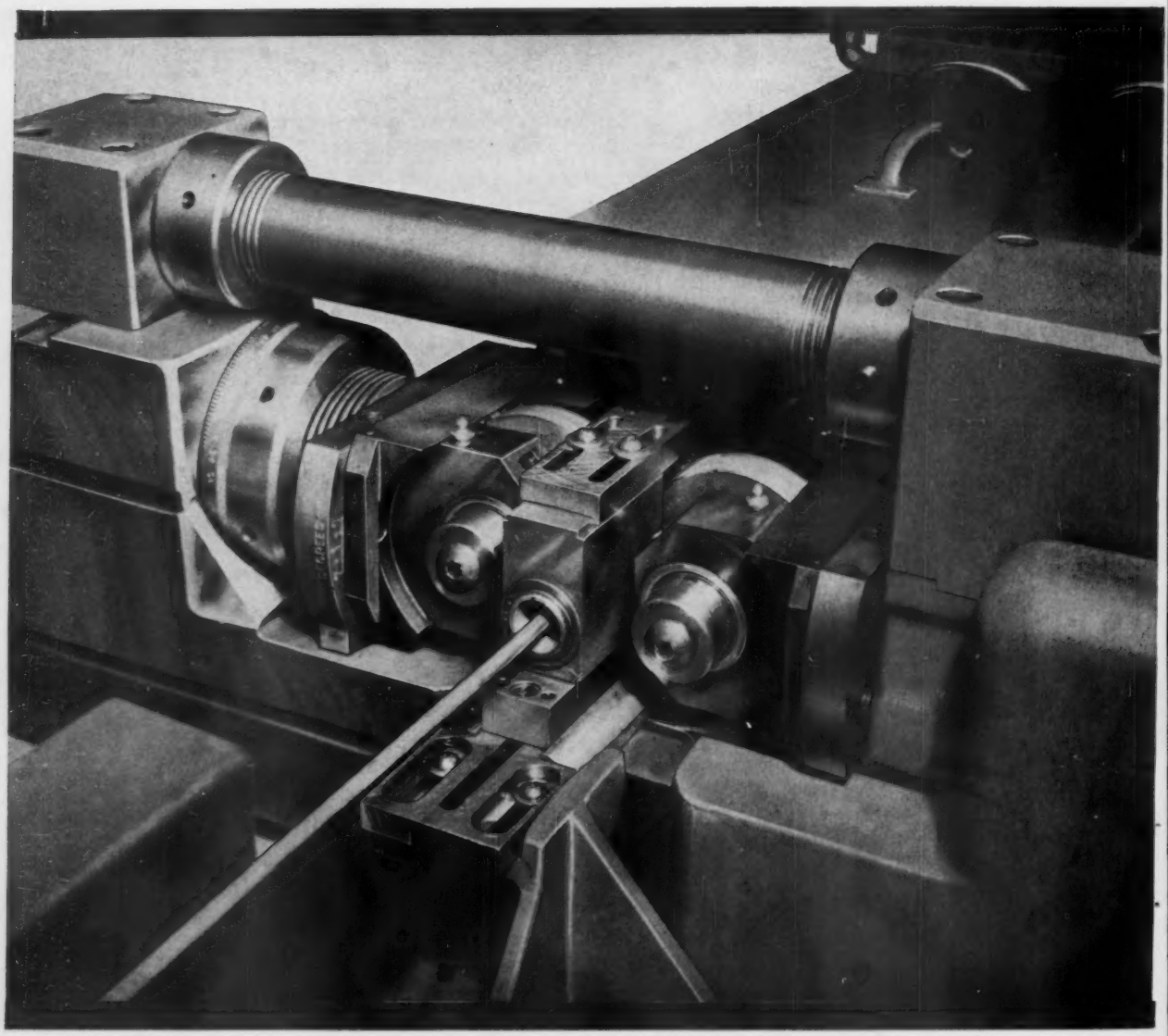
3BH Automatic Hydraulic 1½" Capacity

25AH Automatic Tape Controlled 1¼" Capacity

2BHT-3BHT Automatic Tape Controlled ¾" and 1½" Capacity

LAN·NU·ROL
THREAD ROLLING MACHINE

proved ideal for jobbing operation



To meet the requirements for a job-type high production threading operation, the Threaded Rod Co., Indianapolis, Indiana chose the small and low-cost, rugged and simple, cylindrical-die LAN-NU-ROL Thread Rolling and Forming Machine.

Officials of the Threaded Rod Co. report that the LAN-NU-ROL Machine has been operating perfectly with no breakdowns or any other trouble. Furthermore, roll life is excellent. For example, in the ¼", 20P size operation, 300,000 feet have been rolled on the original dies.

The LAN-NU-ROL'S design concept is formed on the basis of simplicity, rigidity and power; accuracy and versatility; low first-cost, low die cost and uncomplicated set-up and service. The design is based on the two-roll principle in order to obtain the maximum spindle and bearing capacity. Also, the two-die principle minimizes die cost, set-up time and auxiliary equipment.

The LAN-NU-ROL is ideally suited for thru-feed rolling and a full complement of automatic feeding equipment is available for threading by this method. Although intended primarily for hand-loaded infeed rolling operations, automatic feeds can be supplied for infeed rolling wherever practical. The range of the LAN-NU-ROL is: Infeed—2" maximum diameter, 8 T.P.I.; Thrufeed—1" maximum diameter, 8 T.P.I.

625C

SPECIFICATIONS

Workpiece	Threaded Rods
Lengths	3 ft., 6 ft. and 12 ft.
Material	1018 cold rolled steel
Sizes being rolled	¼", 20P—5/16", 18P— ⅜", 16P—½", 13P— ⅝", 11P—¾", 10P— ⅞", 9P—1", 8P

LANDIS *Machine* COMPANY WAYNESBORO • PENNSYLVANIA
THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

UP TO TWICE AS MANY CUTS PER WHEEL

WITH BAY STATE'S NEW HUSTLER CUT-OFF WHEELS

This unretouched photo shows Bay State's HUSTLER cutting a straight, smooth slot with parallel sides. No sign of flutter while cutting because Bay State's HUSTLER resists bending even when it's deliberately twisted. Pebble-grain on sides of wheel insures free cutting action even in large-section cuts.

This is one of the most important developments in abrasive technology in the last five years. Even under brutal operating conditions, Bay State's new HUSTLER wheel has *proved* its ability to outperform ordinary cut-off wheels by as much as two-to-one. Longer life means additional economy because less down-time is required for wheel replacement . . . you do not have to throw away HUSTLER wheels before they are completely used.

Secret of the new wheel's phenomenal performance (see test results at right) lies in two exclusive characteristics developed by Bay State's R & D staff:

1. Extreme rigidity Entirely new bond formulation and reinforcement technique weld Bay State's HUSTLER wheel into a single, homogeneous unit so rigid it virtually eliminates fluttering. Rugged tests have proven its ability to resist chipping, shattering or delaminating.

2. Pebble-grain side surfaces Actual abrasive grain pebbles the side surfaces of this unique new wheel and keeps it cutting smoothly even when the wheel or the work is twisted or cocked.

BAY STATE

Many ordinary wheels, like the one in this unretouched photo, cut wide, vee-shaped slots. Notice gaps between wheel surfaces and edges of slot due to excessive flexing of wheel under stress of cutting action. Such wheels often reach danger point and have to be discarded when only one-third or less has been used.

TYPICAL CUTTING TEST RESULTS

1. STAINLESS STEEL	Sq. In. Wheel Used	Sq. In. Material Cut	Cost per Cut
"HUSTLER" WHEEL	66.7	65.0	$.0375
COMPETING WHEEL	83.8	65.0	$.0450

2. PHOSPHOROUS BRONZE	No. of Cuts	Time	Wheel Wear
"HUSTLER" WHEEL	20	13.2 sec.	1/16"
COMPETING WHEEL	20	10.5 sec.	7/16"

3. AIRCRAFT QUALITY STEEL The "Hustler"... "fastest cutting wheel ever used, and furthermore it made 84 cuts against 56 cuts by the best competing wheel."

4. CHROME STEEL	No. of Cuts	Wheel Wear
"HUSTLER WHEEL"	24	2-1/4"
COMPETING WHEEL	12	6-1/8"

THE HUSTLER cuts ferrous and non-ferrous materials such as: Aluminum, Brass, Bronze (including manganese and aluminum bronze), Cast Iron, Ductile Iron, Stainless Steel.

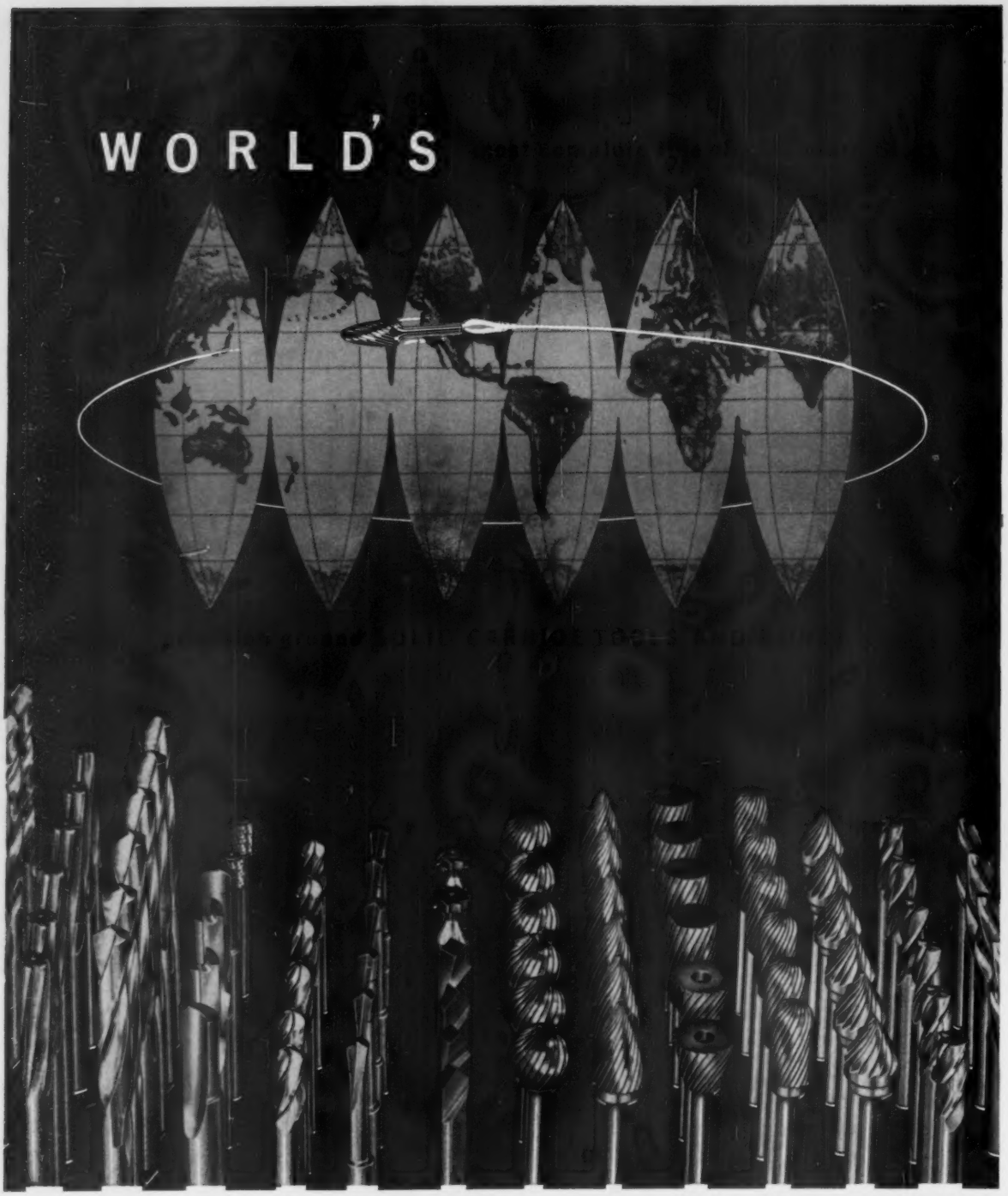
Write for free Technical Bulletin for full details.

ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh.
Distributors: All principal cities.

BAY STATE
WHEELS of PROGRESS

CIRCLE 280 READER SERVICE CARD



Atrax

Send for Catalog and Prices

ATRAX SHOP TESTED TOOLS FOR OUTSTANDING PRODUCTION PERFORMANCE

From ¾" diameter solid carbide end mills to miniature 1/64" diameter "Micro" reamers, Atrax precision ground tool uniformity guarantees a production bonus. There is now an Atrax tool or bur engineered and shop tested for any conventional milling, drilling, off-hand grinding or bur operation.

Atrax distributors extend speedy off-the-shelf tooling service throughout the free world!

THE ATRAX COMPANY, NEWINGTON 11, CONNECTICUT, U.S.A.

Production Pointers

from GISHOLT

More cost-cutting IDEAS— to help you

COMBINED OPERATIONS CUT BALANCING COSTS AT WISCONSIN MOTORS CORPORATION

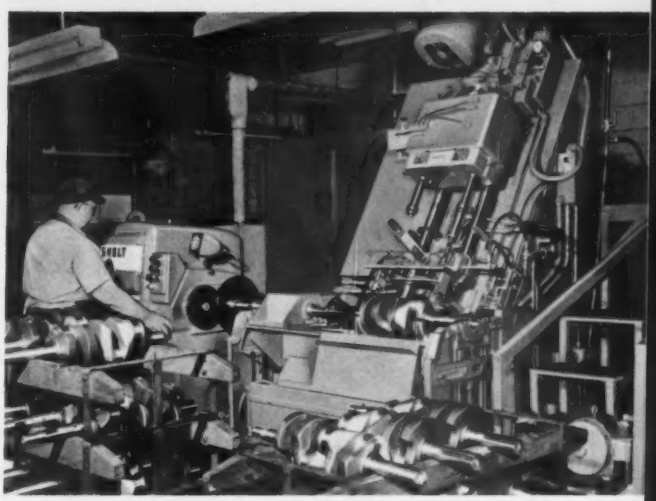
Gisholt Balancer replaces two machines . . . improves quality

How long would it take you to recover the cost of a new balancer if it permitted you to perform the entire operation . . . including correction and inspection, in one fast handling? This setup at Wisconsin Motors Corporation, Milwaukee, Wisc., will give you a good idea of the savings that can be yours . . . if you come to Gisholt.

Four different crankshafts are used in Wisconsin Motors Corporation's extensive line of heavy-duty air-cooled engines. Previously, unbalance was located and measured on two machines. Parts were removed for correction by grinding and returned to the balancers for inspection. Two operators were needed. Time was long . . . and accuracy suffered through multiple handlings and operator interpretation of unbalance indications. Now, *one* Gisholt MASTERLINE 2U Balancer with integral correction drilling equipment does the job.

Although quality is improved, operator effort is reduced to a minimum. One-half ounce inch tolerances are maintained by automatic controls that free the operator from all complicated decisions. Idle time is cut by positioning blocks, job-setup charts, pre-set drills, quick-change adapters, and interchangeable drill heads and depth control cams. One man can change-over to any size crank in two hours or less.

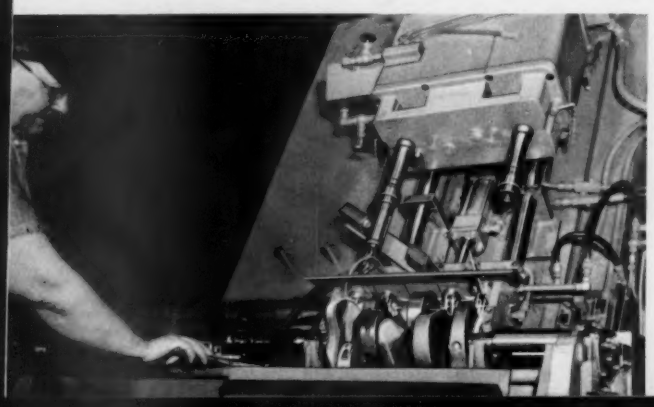
Work is held in a fixture which is locked while weights are attached to the pin bearings to simulate effects of connecting rods and pistons in the final assembly. During rotation the operator flips two levers to locate angle and measure amount of unbalance in both planes. He turns two handwheels to set angularly graduated protractors that provide a visual record of the angle for each plane. He turns separate dials to *electrically* register the amount of unbalance in each plane. Then the operator stops rotation and locks the fixture. He indexes the part to the recorded angle in the plane where the drill is already in place from the previous correction and presses a button. Because the amount of unbalance has been electrically registered, the drill feeds to the required depth in the counterweight with no further attention by the operator. The drill is removed and placed in the head for the other plane and the process is repeated. Then the fixture is unlocked and the work rotated for inspection.



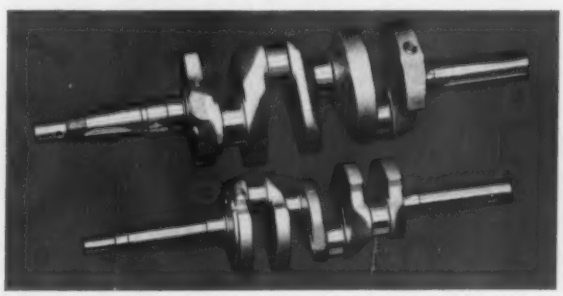
Crankshaft rotates at 300 rpm and is supported on half-bearings in fixture that locks for correction drilling operations. Integral correction drilling equipment improves accuracy, permits one operator to perform complete sequence in one handling.

One Gisholt 2U Balancer replaces two machines, eliminates multiple handling and improves quality by combining location, measurement, automatic correction and inspection. Ask your Gisholt Representative to show you how these principles can be applied to your parts.

For more information on Balancers, circle No. 768.



Operator indexes work to indicated angle and presses button for automatic correction in left plane by 7/8" drill starting at 3 7/8" radius on crankshaft counterweight. Pre-set drill in quick-change holder is shifted easily from right to left plane. Entire drill head is replaced to minimize changeover time.

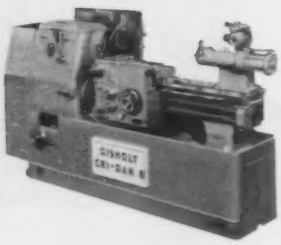


Top . . . largest part handled . . . weight 100 lbs. . . . produced in lots of 125. Previous production 4 per hour . . . now 8 per hour. Smallest part at bottom . . . weight 35 lbs. . . . produced in lots of 2,000. The 2U Balancer locates, measures, corrects and inspects at rate of 15 per hour.

OLD PROBLEMS SOLVED WITH NEW METHODS AT FORD TRACTOR & IMPLEMENT DIVISION

The next page and a half contains an article explaining how Ford Motor Company's Tractor and Implement Division, Birmingham, Michigan, has cut costs and improved product quality by trying two new approaches. Even more important is the fact that these goals were accomplished with *less* investment than would have been required had they purchased so-called "conventional" equipment to do this work.

BY AUTOMATICALLY MACHINING AND THREADING . . . Cri-Dan B offers low tool costs, peak accuracy and minimum threading times.

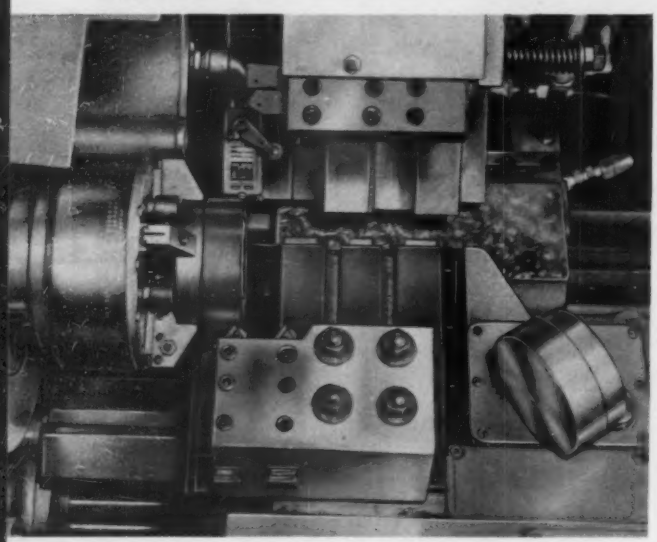


It's a fact. The new Cri-Dan Method can cut your threading costs by 30% to 80% with no compromise on quality. Here is how it is used in Ford Motor Company's Tractor and Implement Div., Birmingham, Michigan, to machine and thread SAE 1020 hydraulic accumulator cylinder ends.

Two sizes are handled. The same tools are used for both. After rough-machining, they are finished machined and threaded on a CRI-DAN B automatic threading lathe.

During the fast automatic cycle on the part shown, a 1⅛" long, 16-NS Class 3A thread is generated on the 4⅜₁₆" diameter end in 22 passes with the single-point carbide threading tool. A second tool lags the threading tool and removes the partial thread created at the start of the cut. This eliminates any weak section that might roll over and cause service problems. At the same time, two tools on a rear facing slide step-face the end with automatic tool relief at the end of the cut. Time . . . only 1.3 minutes f.t.f.

Simple Cri-Dan B setup saves time by combining facing and threading operations. A 1⅛" long, 16-NS Class 3A thread is generated by the single-point carbide threading tool in the front threading slide while the end is step-faced from the rear. Time . . . only 1.3 minutes f.t.f.



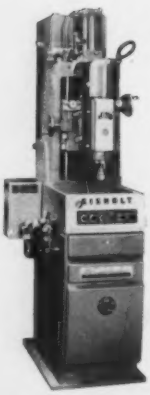
This is a typical Cri-Dan job. The tooling looks simple . . . and it is, because the *inexpensive* single-point carbide tool can be set up in 8 to 15 minutes to produce any kind of thread . . . automatically. Even in the toughest materials, threads are produced in a fraction of the time required by other methods. You can eliminate costly thread milling cutters, thread grinding wheels and special taps and dies. And you can combine standard machining or tracing with threading during the automatic cycle, for maximum efficiency.

Cri-Dan reduces time, tool costs, and work-handling. Combines machining and threading, offers finer finish (125 microinches rms) and repeat accuracy on Class 3A threading operations.

For more information on CRI-DAN, circle No. 769.

BY CUTTING FINISHING TIME ON FLAT SURFACES

Superfinish eliminates grinding saves 50% on variety of transmission parts



If you think Superfinish is used for cylindrical surfaces only, you may be missing out on important savings. *Gisholt* Superfinish can be used to cut time and tool costs on cylindrical, *flat*, *tapered* or *spherical* work. It can also eliminate tedious, more expensive methods.

For example, this setup at Ford Motor Company's Tractor and Implement Div., Birmingham, Michigan, has eliminated flat surface grinding and cut time in half on nine automatic transmission parts. Seven are Superfinished at both ends and two on one end for a total of 16 surfaces. Two, identically tooled MASTERLINE Model 81 Vertical Superfinishers handle all production.

Five of the parts are illustrated with some of the Superfinished surfaces indicated by arrows. The part in the air operated expanding mandrel fixture on the lower work spindle is a planetary gear carrier. During the automatic cycle, the Superfinish wheel descends to engage the flat surface and rotates in an opposite direction to the work spindle. A special variable speed drive arrangement keeps cross-hatch pattern to a minimum as the precision-faced surface is reduced from 120 to 10 microinches rms. Floor-to-floor time . . . only 30

continued on next page

FORD STORY . . . CONTINUED

seconds. The other parts are handled in the same manner . . . to the same degree of finish . . . in the same amount of time.

With Superfinish you get any surface you require . . . whether it's 1 microinch rms or 80, piece-after-piece, automatically! Part geometry is improved, surface imperfections are eliminated, and jagged peaks are "scrubbed" away, giving up to 80% more bearing area. Smear metal is removed and base metal exposed so that specified hardness is maintained, to assure long service life.

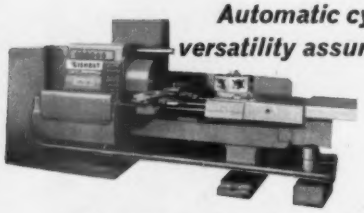
Flat surface Superfinishing eliminates grinding, cuts finishing time in half on nine transmission parts. Offers further savings in initial cost, setup time and tooling.

For more information on Superfinish, circle No. 770.

One of two identically tooled Gisholt MASTERLINE Model 81 Vertical Superfinishers used to handle 16 surfaces on nine different automatic transmission parts. On each part, the precision-faced flat surfaces of 120 microinches rms are reduced to 10 microinches rms in only 30 seconds, f.t.f.

NEW FASTERMATICS OFFER 15 MINUTE CYCLE SETUP

Automatic cycle plus turret lathe versatility assures maximum profits



This story illustrates how non-productive setup time has been reduced to a minimum, so you can get all the advantages of turret lathe practice with an automatic cycle on short or long run work.

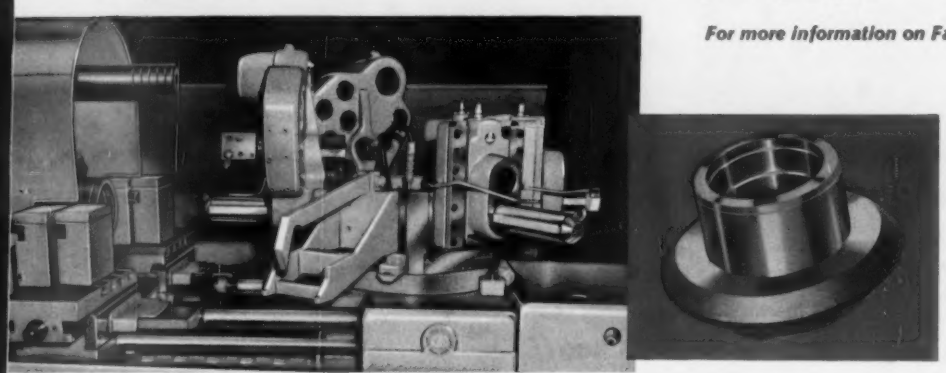
The machine shown is a new Gisholt MASTERLINE 3F Fastermatic with FeeDial Control. Fast, 15-minute setup makes the Fastermatic ideal for short run use. Individual dial controls select the *exact* feed for each station. The feed rate is shown in *inches per revolution* in windows at the top of each dial! Selector panel switches are "flicked" to pre-set speeds and machine functions for the six turret and two cross slide stations. Adjustment of traverse and feed trips, on a small hex drum at the headstock end completes the cycle setup.

Tool setting time is also reduced. The operator can take a test cut at *any* station, back up, mike the part, reset his tools and repeat the sequence *without indexing through the other five stations.*

The 3F FASTERMATIC is shown tooled for first operation work on 11⅝″ diameter, 7″ long steel bevel pinion forgings. A turret-mounted loader speeds locating and chucking. During the cycle, hex turret stations rough and finish turn two O.D. diameters, core-drill and finish three bore diameters. Rear and front cross slide tools operate with hex stations 1 and 2 respectively, to rough and finish machine two faces. Rigid machine design and a 40 hp motor permit rough turning using .015″ feeds to remove up to ⅝″ stock per side and core-drilling with up to ½″ stock per side removed. Time is 13.3 minutes f.t.f.

The Fastermatic with FeeDial Control is available in three sizes. Fast 15-minute cycle setup, heavy metal removal capability and turret lathe flexibility guarantees top profits on your toughest parts.

For more information on Fastermatics, circle No. 771.



Tooling setup . . . utilizes turret-mounted loader (front) to speed locating and chucking of heavy part. Note how multiple tools are used with the automatic cycle to machine a maximum number of surfaces per chucking . . . to consistent quality at fixed rates. The operator is *free* during the automatic cycle to handle other machines. Inset shows workpiece and surfaces machined in only 13.3 minutes floor-to-floor.

TRACING SIMPLIFIES TOUGH CONTOURS AT WALTER KIDDE

JETracers on ram and saddle type turret lathes save time and tool costs

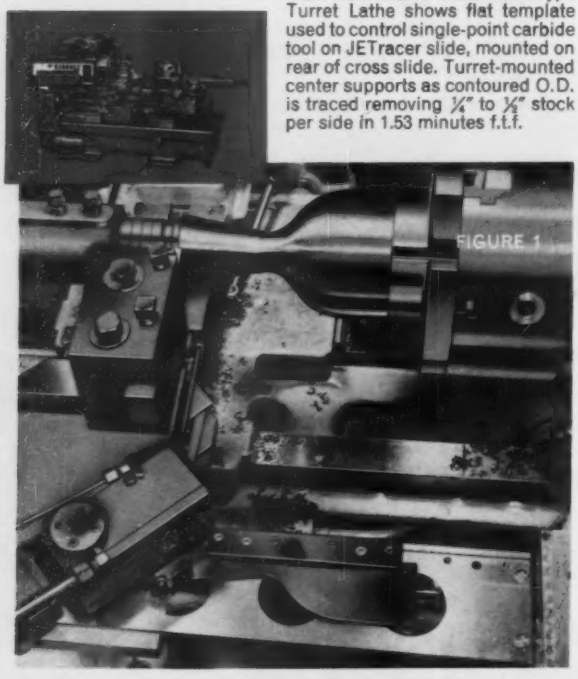
Walter Kidde & Company, Inc. of Belleville, N.J., has produced thousands of forged steel Jato nozzles each month—used to boost "take-off" power of heavily loaded aircraft. The way they solved the problems of machining tough internal and external contours may give you some ideas for your own operations.

The parts shown in these setups are 9⅛″ long. Diameters range from 2¾″ at the small end to 5⅛″ at the bell end. For first operation machining of the bore, a Gisholt 2L Saddle Type Turret Lathe is used. The setup is shown in Fig. 2 . . . the workpieces at left in Fig. 3. Work is held in a pot-type collet fixture. A turret-mounted JETracer slide tool removes from ⅜″ to ½″ per side at .011″ feed as it completes the 7″ long I.D. contour. Surface speeds range from 580 to 200 feet per minute. Time is only 3.48 minutes f.t.f.

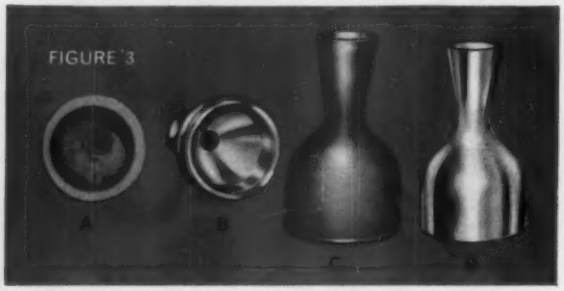
A Gisholt Ram Type Turret Lathe is used for second operation machining of the O.D. contour. The setup is shown in Fig. 1 . . . the work pieces at right in Fig. 3. Work is held in the bore on an air chuck and located at the bell end against three special jaws that distribute chucking pressures to avoid possible distortion. A turret-mounted center provides additional support. A single-point carbide tool on the JETracer, mounted on the rear of the cross slide, is governed by the flat template as it removes from ¼″ to ½″ per side at .021″ feed, to complete the 11″ long O.D. contour. Again, surface speeds range from 200 to 580 feet per minute. Time is 1.53 minutes f.t.f.

Even though you may not machine Jato nozzles, tracing can offer many cost-cutting advantages. These include fast setup and changeover, simplified machining and minimum requirements for operator skill. Costly form tools, multiple tool blocks and holders can be eliminated. Inspection time is reduced and there are fewer secondary operations.

Gisholt 2L Saddle Type Turret Lathe with turret-mounted JETracer slide tool, used for first operation contour boring of Jato nozzles in 3.48 minutes f.t.f. JETracer stylus follows flat template held on carrier bar and has micrometer adjustment. Template and carrier bar locate from adjustable bracket attached to overhead pilot. Entire assembly can index with turret and does not restrict use of other tooling.



View from rear of No. 5 Ram Type Turret Lathe shows flat template used to control single-point carbide tool on JETracer slide, mounted on rear of cross slide. Turret-mounted center supports as contoured O.D. is traced removing ¼″ to ½″ stock per side in 1.53 minutes f.t.f.



First operation machining handled on Gisholt Saddle Type Turret Lathe with turret-mounted JETracer slide tool. Rough part at (a); machined part at (b). Second operation machining handled on Gisholt Ram Type Turret Lathe with JETracer mounted on rear of cross slide. Rough part at (c); machined part at (d).

Gisholt offers over 28 different JETracers for use with manual and automatic turret lathes and single-spindle automatics. Each operates at full capacity of the machine to which it is applied and does not limit machine functions or restrict use of standard tools.

For more information on JETracers, circle No. 772, on Rams, circle No. 773, on Saddles, circle No. 774.

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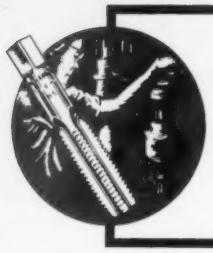
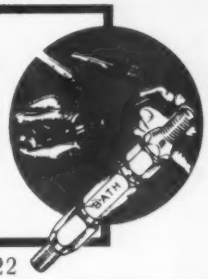


BATH *Tap'n Gage* TIMES



A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 22

Subject: Popular Series Taps for Blind Hole Tapping Aluminum, Magnesium and Die Castings.

Bath has developed a series of popular size taps to give maximum performance in aluminum, magnesium and die castings. The increased use of these materials for production parts such as engine blocks and other components makes it desirable to use taps designed for these particular applications.

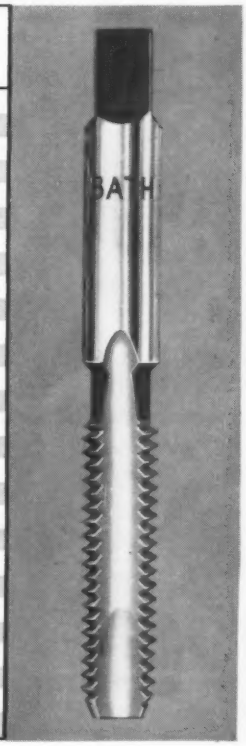
These taps, available from stock, have a special flute form and angle, ground after thread grinding and designated — Deepened Flute, Extra Hook. This assures a keen cutting edge — will remove, not push material — avoids "closing in" on Go thread gage. An abrasion resisting surface treatment prolongs tap life.

Users specifying Spiral Fluted taps for these applications will find that Bath Deepened Flute Extra Hook Taps outperform them in many instances and sell for 30% less. These taps can also be used for through holes but a spiral point is generally preferable.

Convince yourself that Bath Deepened Flute Extra Hook Taps for blind hole tapping aluminum, magnesium and die castings are superior. Take advantage of our offer and try a Bath Tap on this type of application — and see the difference!

Listed in the table below are some of the standard sizes and pitch diameter tolerances available from stock.

Tap Size	Threads per inch		Basic Major Diameter	Basic Pitch Diameter	Standard Pitch Diameter Tolerances					Number of Flutes	Length Overall	Thread Length
	NC UNC	NF UNF										
#3	48		.099	.0855	H1	H2				2	1 13/16	1/2
#3		56	.099	.0874	H1	H2				2	1 13/16	1/2
#4	40		.112	.0958	H1	H2				2	1 7/8	9/16
#4		48	.112	.0985	H1	H2				2	1 7/8	9/16
#5	40		.125	.1088	H1	H2				2	1 15/16	5/8
#5		44	.125	.1102	H1	H2				2	1 15/16	5/8
#6	32		.138	.1177	H1	H2	H3			2	2	11/16
#6		40	.138	.1218	H1	H2				2	2	11/16
#8	32		.164	.1437	H1	H2	H3			2	2 1/8	3/4
#8		36	.164	.1460	H1	H2				2	2 1/8	3/4
#10	24		.190	.1629	H1	H2	H3			2	2 3/8	7/8
#10		32	.190	.1697	H1	H2	H3			2	2 3/8	7/8
#12	24		.216	.1889	H1		H3			2	2 3/8	15/16
#12		28	.216	.1928	H1		H3			2	2 3/8	15/16
1/4	20		.250	.2175	H1	H2	H3		H5	2	2 1/2	1
1/4		28	.250	.2268	H1	H2	H3	H4		2	2 1/2	1
5/16	18		.3125	.2764	H1	H2	H3		H5	2	2 23/32	1 1/8
5/16		24	.3125	.2854	H1	H2	H3	H4		2	2 23/32	1 1/8
3/8	16		.375	.3344	H1	H2	H3		H5	3	2 15/16	1 1/4
3/8		24	.375	.3479	H1	H2	H3	H4		4	2 15/16	1 1/4
7/16	14		.4375	.3911			H3			3	3 5/32	1 7/16
7/16		20	.4375	.4050	H1	H2	H3		H5	4	3 5/32	1 7/16
1/2	13		.500	.4500	H1	H2	H3		H5	4	3 3/8	1 21/32
1/2		20	.500	.4675	H1	H2	H3		H5	4	3 3/8	1 21/32
9/16	12		.5625	.5084	H1	H2	H3		H5	4	3 19/32	1 21/32
9/16		18	.5625	.5264	H1	H2	H3		H5	4	3 19/32	1 21/32
5/8	11		.625	.5660	H1	H2	H3		H5	4	3 13/16	1 13/16
5/8		18	.625	.5889	H1	H2	H3		H5	4	3 13/16	1 13/16



FOR A FREE TRIAL TAP, WRITE US ON YOUR LETTERHEAD SPECIFYING THE SIZE, PITCH AND CLASS OF FIT REQUIRED; TYPE OF MATERIAL BEING USED AND A DRAWING OR SKETCH OF THE PART TO BE THREADED. ACT PROMPTLY — THIS OFFER IS FOR A LIMITED TIME

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...B-56, an unparalleled advancement for all carbide grinding ...wet and dry

Since Norton Company developed the first diamond wheels for industry in 1929 it has been the leader in diamond wheel progress — first the resinoid bond, then the metal and vitrified bonds.

Now comes another "first" from Norton, a brand-new bond, the B-56, an outstanding development combining greater productivity and economy for either wet or dry carbide grinding in ONE bond — providing the finest diamond wheels, the Dia-Crown line, ever produced for tool sharpening, die grinding and all other carbide toolroom or production jobs.

In test after test on the widest range of carbide grinding, wet and dry, in customers' plants, Norton Dia-Crown B-56 wheels have outperformed all other wheels with major results — per job — including the following:

- Increased volume of carbide removed, per unit of time.
- Longer wheel life without sacrificing speed of cut.
- More workpieces handled per wheel.
- Considerably lower wheel cost per cubic inch of carbide removed.

Believable? . . . It sure is! Look at these quotes from customer reports!

"*Wheel was so good we could hardly believe it, and checked test results again . . . still showed 30% longer wheel life.*"

"*This wheel reduced grinding costs from 13¢ to 7¢ per tip.*"

"*An extremely fine wheel. Cuts more carbide in a given time than any other wheel.*"

"*Best wheel ever used. Will convert to this for all our diamond wheel operations.*"

That's what our customers say — and it's due to this entirely new Norton resinoid bond — a truly outstanding development. Norton Dia-Crown wheels with this new bond are available in all types and sizes for carbide grinding. Remember, too, that if two wheels of the same size and type have been required for wet and dry grinding — this ONE new wheel will now do both — wet *or* dry, reducing inventories and cutting costs.

Get complete facts on how this new Dia-Crown line of diamond wheels can improve your carbide grinding and save you time and money. See your Norton Man, a trained Abrasive Specialist, or your Norton Distributor. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

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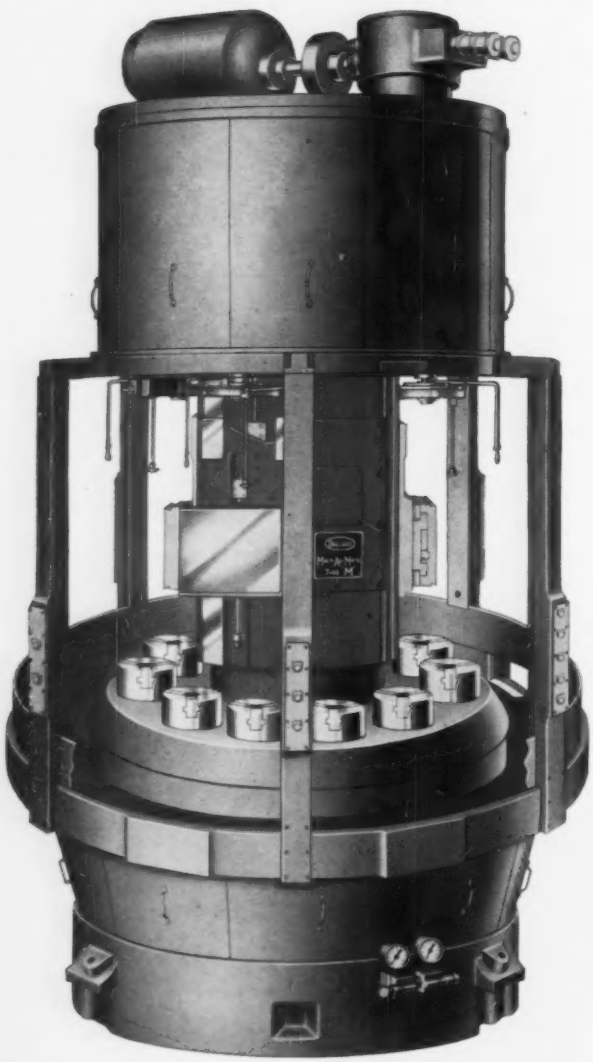

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To achieve the same production output obtainable from a Bullard Mult-Au-Matic, Type "M", competitive methods would require a greater investment of capital funds.

Built to exacting Bullard standards, the Type "M", available with 6, 8, or 12 spindles, incorporates in its design many features which insures its rigidity, accuracy, and productivity, even on difficult machining jobs.

For complete Mult-Au-Matic, Type "M" information, write for a catalog or call your nearest Bullard Sales Office or Distributor.

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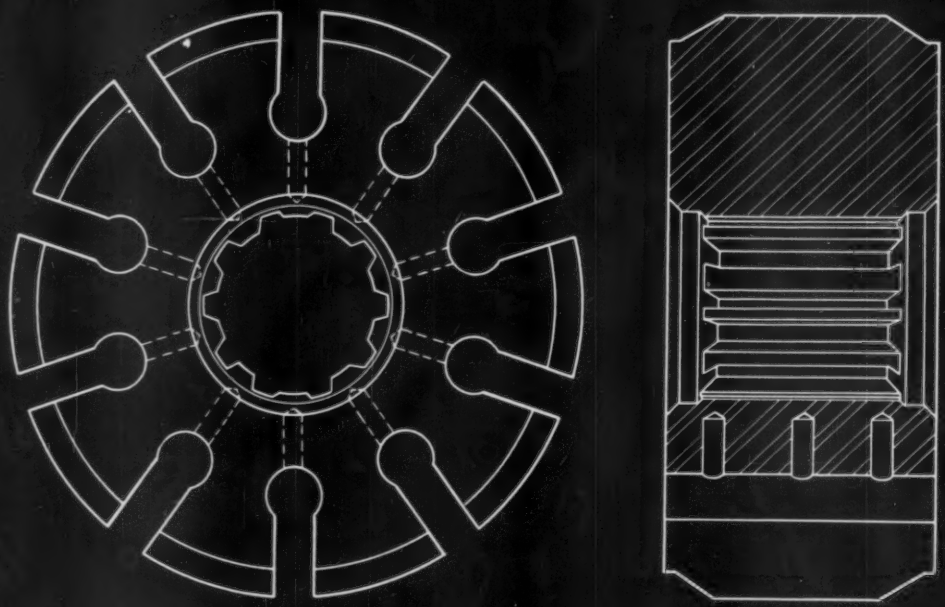

VANE TYPE HYDRAULIC PUMP ROTOR machined from a 4150 steel forging. Operation: Broaching splines and vane slots. Tolerances: .001" before grinding.

Denison Engineering Division, American Brake Shoe Company, makes a broad line of precision hydraulic presses, pumps and controls. Cost of tool change down time on three vertical broaches was high. Denison turned to Mobil for help.

Mobil recommended use of its new Mobilmet 27 cutting oil. Down time was reduced over 30% . . . 44.5% fewer tool grinds were needed . . . with five-figure savings any plant would welcome.

Mobilmet 27 is a unique cutting oil. Its pressure-temperature-selective additive composition was developed and patented by Mobil. We know that even in a single cutting operation, pressures, temperatures and other conditions can vary widely. Mobilmet oils have an inbuilt ability to adapt to these variables. They have given a new and really broad meaning to the words multi-range, multi-metal, etc.

Mobilmet 27 keeps tools sharp far longer, with substantial savings. Hard, brittle and draggy metals of many kinds are machined to close tolerances, often with no subsequent finishing operation. Speeds and feeds can often be increased with fewer tool grinds. Staining problems are minimized.

Vernon Smith, Assistant Plant Engineer (at right), and Mobil Representative H. M. Lamb inspect vane pump rotor at Denison's Delaware, Ohio plant.

Look into these remarkable Mobilmet oils. You can get details quickly from your Mobil Representative or by writing to: Mobil Oil Company, 150 East 42nd Street, New York 17, New York.

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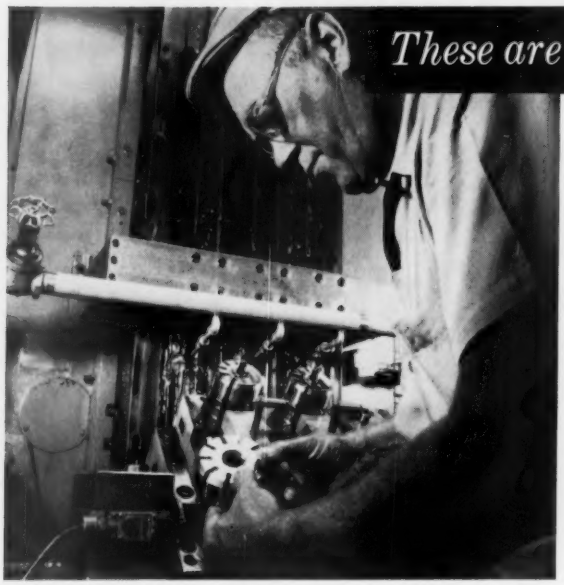
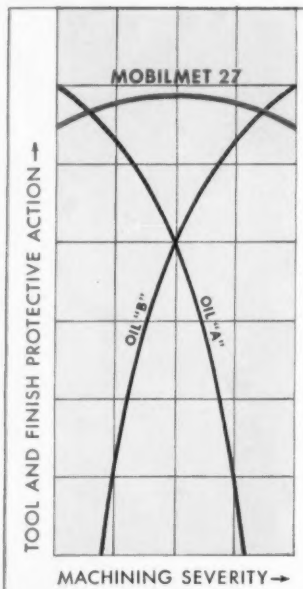


These are the savings:

$24,606 saved in production time. Yearly tool change down time on Denison's three broaches was 1,333.2 hrs., valued at $40 an hour—$53,328 yearly. Using Mobilmet 27, this cost was cut to $36,924, saving $16,404 annually—$24,606 for the 18-month period of use.

$5,737.50 saved in tool grinding. Broach strings formerly required 165 tool grinds yearly for the three machines. With Mobilmet 27, only 114 tool grinds were needed yearly. Thus, Denison saves 51 tool grinds yearly at $75 each—$3,825 a year, $5,737.50 for 18 months.

When the right cutting oil can save $30,343.50, finding that oil is mighty important. Denison found this oil in Mobilmet 27 for broaching slots to .001" tolerances in vane pump rotors that deliver up to 2,000 psi.



MOBILMET 27 with pressure-temperature-selective additive action guards tools . . . speeds work . . . improves finishes.

Mobilmet 27 has a unique ability to handle many metals—many machining conditions, as symbolized here. Red line indicates how Mobilmet 27's tool and finish protective action bridges *both* the conditions met by single-purpose, low-activity oil (A), single-purpose, high-activity oil (B), *and all conditions between.*

The reason: a revolutionary patented additive composition that is pressure-temperature-selective in its action. On tough, draggy steels, Mobilmet 27 has high additive activity, *controlling* built-up edge . . . permits high cutting speeds, assures superior finish and minimum tool wear. And on hard but clean-cutting metals, Mobilmet 27 has low additive activity, *permitting* formation of a proper protective built-up edge . . . allows high cutting speeds, minimizes wear on lip and cutting edge of tool.

One oil replaces many . . . tools stay sharp . . . tool grinds are fewer . . . output is increased . . . tolerances and finishes are improved . . . unit costs are reduced.

Mobil

MOBIL OIL COMPANY
150 East 42nd Street
New York 17, N.Y.

When the job calls for DIAMONDS... say SIMONDS

SIMONDS DIAMOND WHEELS

made with extra care

for extra value

man-made or natural diamonds

You get *extra* use from Simonds wheels because more of the diamonds are *productively* used for actual grinding. That's due to the extra care that goes into their manufacture . . . extra-demanding quality controls, modern techniques and the most accurate equipment . . . extra care that provides better balance and truer running, and consequently, fewer dressings. Special core material in resinoid bonded wheels also needs little or no dressing back as the diamond depth is consumed. Made with true and exact concentrations, and available in all shapes, sizes and bonds. Job-proved grain and grade specifications.
Send for catalog ESA-290.

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FAST SERVICE • LOCAL STOCKS

WEST COAST PLANT: EL MONTE, CALIF.—BRANCHES: CHICAGO • DETROIT • LOS ANGELES • PHILADELPHIA • PORTLAND, ORE. • SAN FRANCISCO
SHREVEPORT—IN CANADA: GRINDING WHEELS DIVISION, SIMONDS CANADA SAW CO., LTD., BROCKVILLE, ONTARIO • ABRASIVE PLANT, ARVIDA, QUEBEC

Combat Rising Costs?

LUCAS

"The advantages of numerical control, combined with the precision quality of the Lucas boring machine are currently reducing manufacturing costs at Sibley on . . .

- **Complicated missile hardware for a major prime contractor.**
- **Short-run lots of gray iron castings for equipment builders.**
- **Major components of the Sibley HT-40 tape controlled drilling machine.**

With this boring machine, only simple work-holding devices are required. Elimination of expensive jigs and fixtures makes the machine ideal for short-run manufacturing—lots of 10 pieces or up to 50 pieces per month have proven to be very economical . . . "

This quote was extracted from material prepared by the Sibley Machine & Foundry Company in South Bend, Indiana. It briefly sums up the story on their model 41 B 48 with Lucas Numra-Tronic Positioning Control to head, table, saddle and rotary table. Your Lucas representative will be happy to fill in the details, or write Lucas Machine Division, The New Britain Machine Co., 12302 Kirby Ave., Cleveland, Ohio.

LUCAS
PRECISION

Choice of Controls?

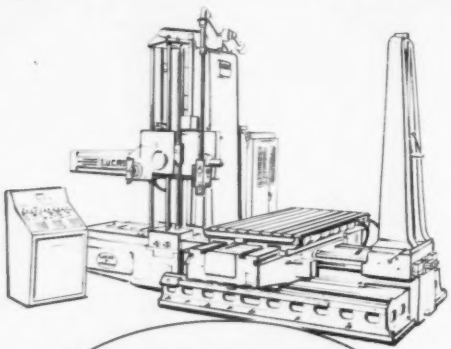
LUCAS

Lucas offers a complete selection of controls for every machine motion. You can select combinations of pendant and lever control, full pendant control and partial or full numerical control.

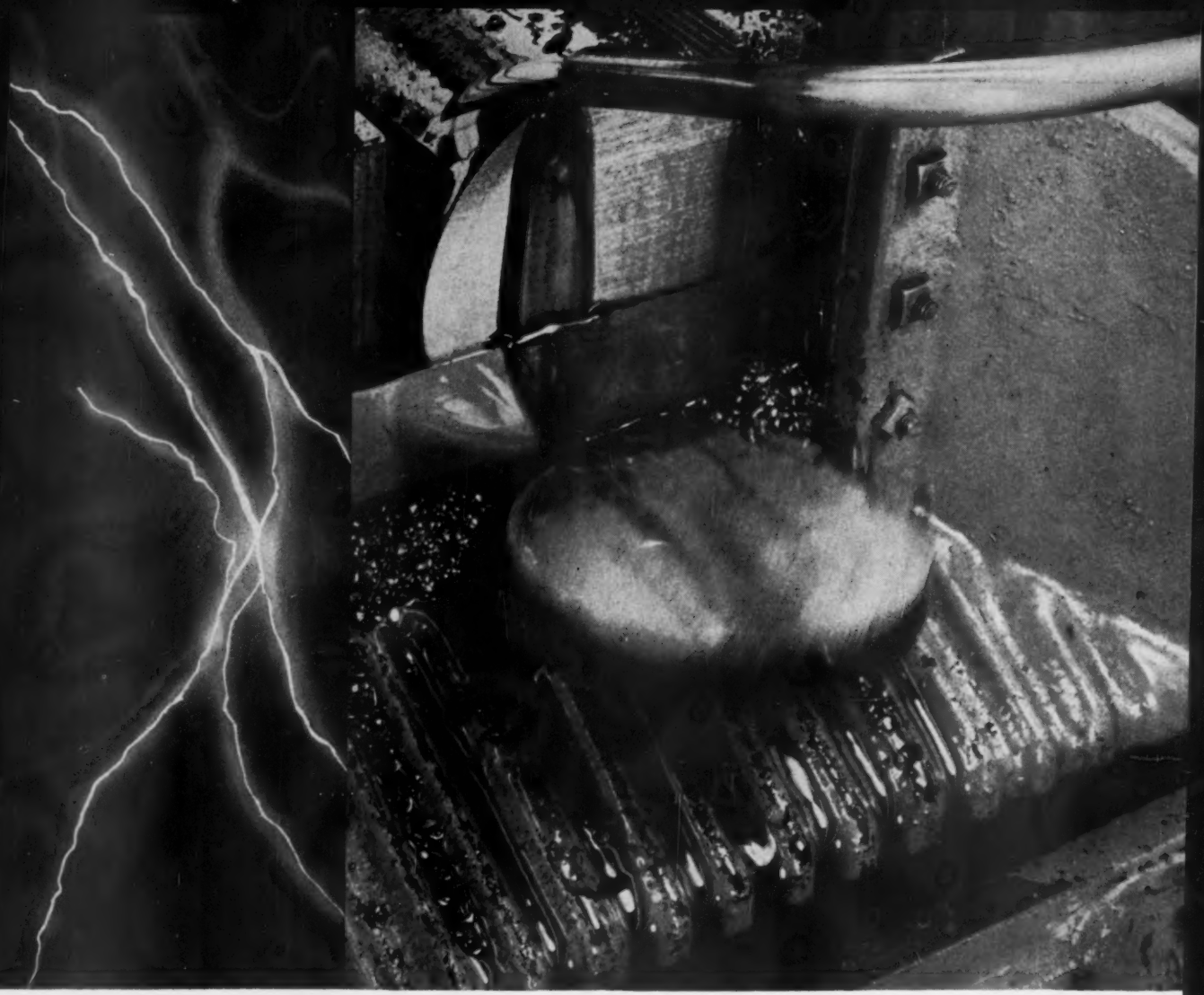
The Multiple Control Pendant selects speeds, feeds, unit travels, rapid traverse of head, table, saddle and spindle, plus spindle rotation forward and reverse, jog and stop. Preselection of speeds and feeds may be accomplished while the machine is in operation.

Numerical control can select travel of head, spindle, table and/or saddle, unclamp units when in motion and clamp when directed. Other functions—tapping cycle, changing of feeds and speeds, spindle power tool lock clamps or ejects tools, spindle dwell, coolant "on" or "off", orientation of spindle stop at a desired point of rotation when using tool magazine, simultaneous motion of unit travels, dual storage of information.

One piece or production runs . . . 2¾″, 3″, 4″, 5″, 6″ or 7″ spindle-diameter models, simple jobs or complex jobs, Lucas has the right horizontal and vertical boring, drilling and milling machines with the controls you need. See your Lucas representative or write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Ave., Cleveland, Ohio.



LUCAS
PRECISION



FAST!

Your hack sawing machines will produce faster cutting-off on all types of work when they are equipped with unbreakable Marvel High-Speed-Edge Hack Saw Blades.

Why? Because these are the blades specifically designed to take the high speeds and heavier feed pressures demanded by today's production schedules.

What's more, your operators know—or will soon learn—they can increase speed and pressure without endangering themselves or the machine, because these are unbreakable Marvel High-Speed-Edge Blades . . . the blades that have set the standard for all other blades to match—if they can.

Ask for Marvel High-Speed-Edge Hack Saw Blades by name and you can be sure you're getting the unbreakable blades designed to give you maximum accuracy and speed in your cutting-off operations. Leading Industrial Distributors have Marvel Blades in stock.

Write for the latest Cutting Tool Bulletin and the name of your nearest Marvel Distributor.

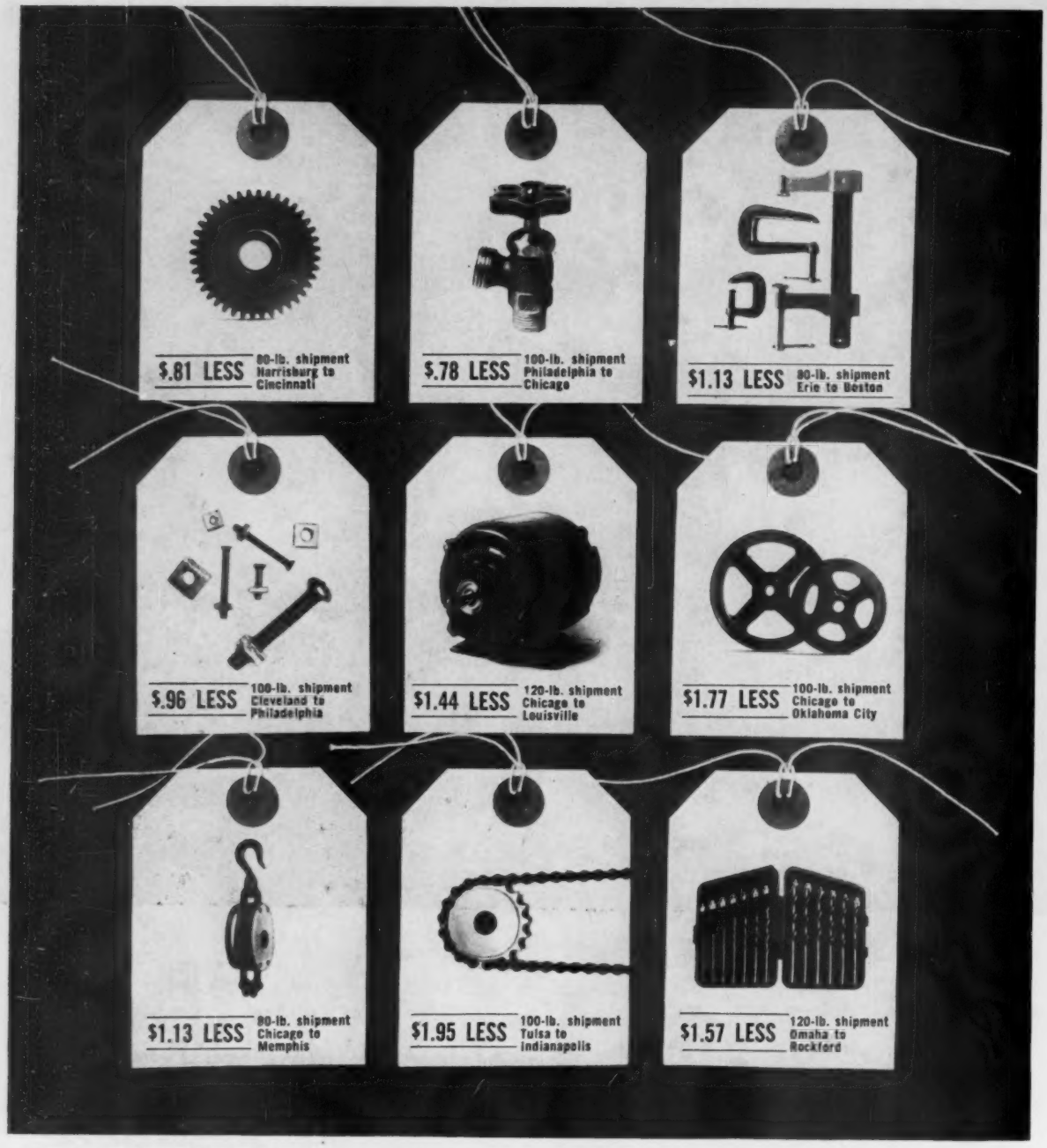
MARVEL *Metal Cutting* **SAWS**

BETTER MACHINES BETTER BLADES

ARMSTRONG-BLUM MANUFACTURING CO. • 5700 Bloomingdale Avenue • Chicago 39, Illinois

◄ CIRCLE 295 READER SERVICE CARD

CIRCLE 296 READER SERVICE CARD


$.81 LESS 80-lb. shipment Harrisburg to Cincinnati
$.78 LESS 100-lb. shipment Philadelphia to Chicago
$1.13 LESS 80-lb. shipment Erie to Boston
$.96 LESS 100-lb. shipment Cleveland to Philadelphia
$1.44 LESS 120-lb. shipment Chicago to Louisville
$1.77 LESS 100-lb. shipment Chicago to Oklahoma City
$1.13 LESS 80-lb. shipment Chicago to Memphis
$1.95 LESS 100-lb. shipment Tulsa to Indianapolis
$1.57 LESS 120-lb. shipment Omaha to Rockford

R E A EXPRESS is on the move with new low charges for machine parts—lower than motor carrier!

Now R E A EXPRESS slashes shipping costs to the lowest point in machine parts history! New rates on thousands of commodities now let you ship at costs that are actually lower than motor carrier for specified weights and destinations.

Call your local R E A EXPRESS representative today for information on these new low rates.

MACHINERY AND MACHINE PARTS

FROM	TO	MOTOR TRUCK MINIMUM CHARGE	R E A CHARGES 80 Lbs.	100 Lbs.	120 Lbs.	SAVINGS BY REA
New York, N. Y.	Buffalo, N. Y.	$4.55	—	$4.15	—	$.40
Cleveland, O.	Philadelphia, Pa.	$5.50	—	$4.54	—	$.96
Milwaukee, Wisc.	New York, N. Y.	$6.46	—	—	$6.25	$.21
Chattanooga, Tenn.	Houston, Texas	$5.35	$4.84	—	—	$.51
Chicago, Ill.	Memphis, Tenn.	$5.03	$3.90	—	—	$1.13
Omaha, Nebr.	Rockford, Ill.	$5.87	—	—	$4.30	$1.57

R E A rates and charges shown include free valuation of $50.00 for any shipment of 100 pounds or less or 50 cents per pound for any shipment in excess of 100 pounds.

HAS A NEW NAME
R E A EXPRESS
TRUCK PLANE SHIP TRAIN

William L. Wearly
President
JOY MANUFACTURING COMPANY
Pittsburgh, Pa.

"THE MACHINE TOOL GAP...
a threat to our world leadership"

"Industry's ability to increase productivity through modernization of equipment and plants has enabled this country to keep ahead of the rest of the world. Through modernization we have offset the advantage foreign manufacturers have with their lower labor costs.

"Failure to rehabilitate obsolete plants and equipment has narrowed the margin of superior productivity and quality. This rapidly developing 'machine tool gap' can cause loss of world leadership and impair our national security.

"At JOY MANUFACTURING COMPANY we recognize that every dollar invested in modern machine tools works for us and for our nation."

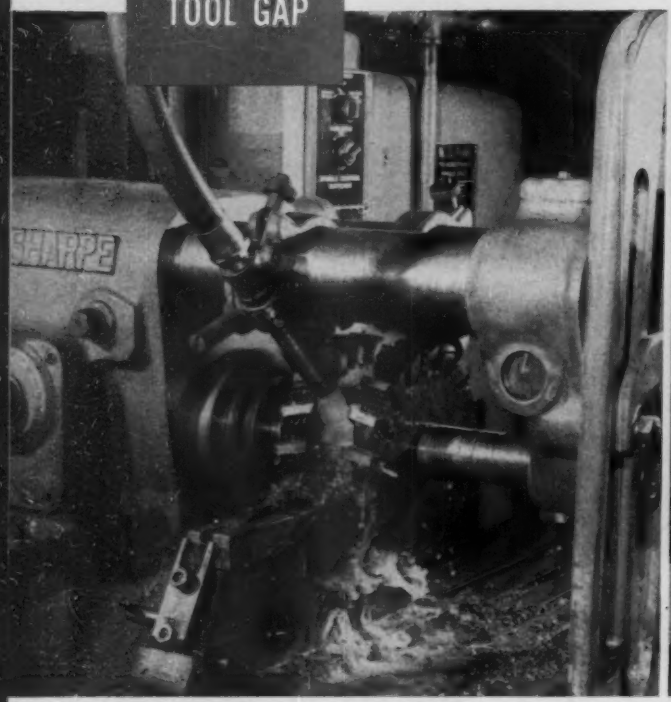
This statement reprinted courtesy of Joy Manufacturing Co.

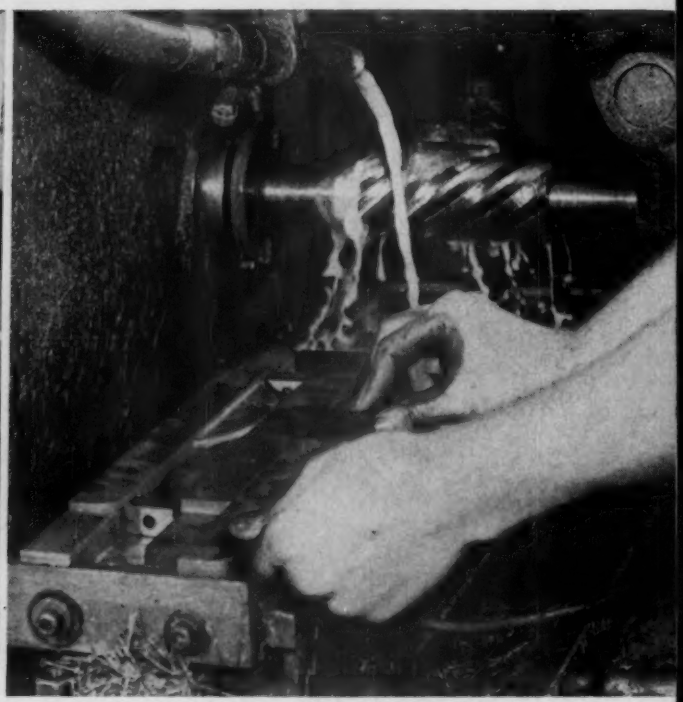
Brown & Sharpe

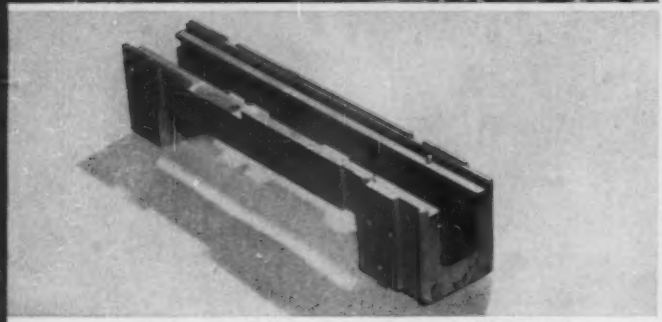
CIRCLE 298 READER SERVICE CARD

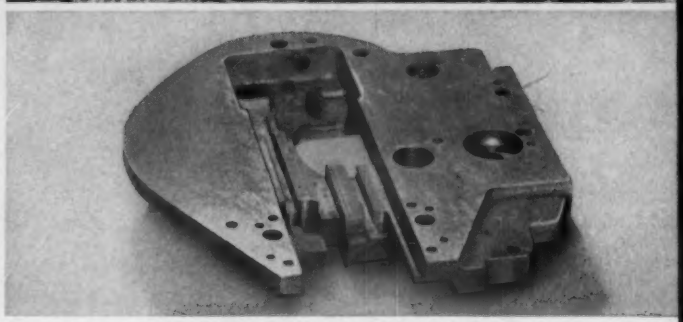
Close the MACHINE TOOL GAP

MODERNIZE MILLING AND MAKE MORE FOR LESS



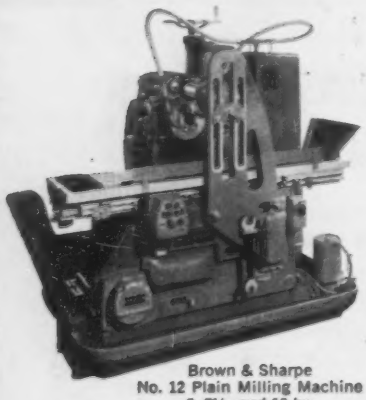






Typical operations are (top left) straddle-milling 3 surfaces of a malleable iron bonnet casting. — (top right) loading a B&S Magnetic chuck used for holding CRS parts while flat surfaces are helical milled. Both machines are 7½ hp models of B&S No. 12. The two other parts shown, with machining completed, illustrate the variety of milling cuts required.

BOSTITCH relies on proved cost-saving of B&S No. 12– builds up production-milling battery to 14 machines



Brown & Sharpe
No. 12 Plain Milling Machine
3, 7½, and 10 hp

At BOSTITCH, Inc., manufacture of staplers and wire-stitching equipment requires multi-cut milling on many different parts. For highest efficiency, ready adaptability, and cost economy, their production staff has long relied on Brown & Sharpe No. 12 Plain Milling Machines. With recent additions, chosen on the basis of proved performance, 14 machines are now in operation.

The many-shaped pieces are held in simple fixtures, and the wide choice of No. 12 automatic milling cycles are fully utilized. Operators simply load and unload the fixture, can tend two or more machines.

On many parts, several surfaces are milled at once with ganged cutters. The automatic climb milling arrangement on the No. 12 makes it possible to take full advantage of higher cutting loads with either conventional or climb milling setups. Tolerances within ±.001", required for a number of parts, are easily met.

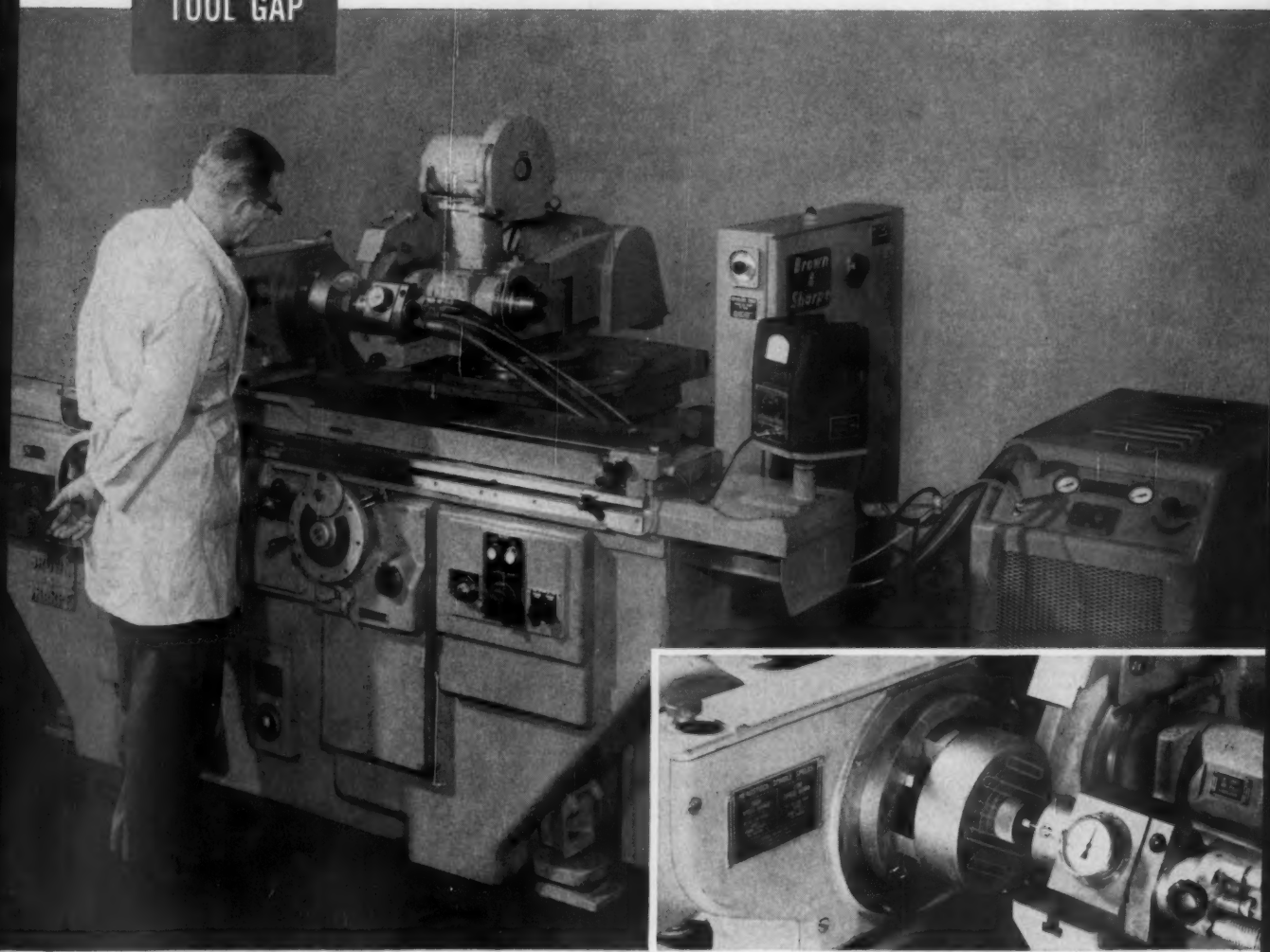
For top returns on your investment in production milling equipment, the B&S No. 12 leads in cost-saving performance. All the operating features needed for fully automatic milling are standard. With special fixtures, you can equal the output of an expensive, single-purpose machine. And, when the work changes, you just change the fixtures, *not* the machines. For details, write: Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Brown & Sharpe PRECISION CENTER

CIRCLE 299 READER SERVICE CARD

Close the MACHINE TOOL GAP

MODERNIZE GRINDING AND MAKE MORE FOR LESS



The No. 2 Universal Grinding Machine (above) is equipped with the new Hydrostatic Internal Grinding Unit, shown (right). The machine is also equipped with the B&S Supercise Hydrostatic Headstock, which permits the same split-tenth precision in external grinding. The hydrostatic pressure control is shown at the right of the machine.

New B&S first - Hydrostatic Internal Grinding unit repeats hole size and roundness within 10 millionths

The Brown & Sharpe Universal shown is the world's first machine to provide repetitive *production* grinding to split-tenth precision in size and roundness, for both external and internal grinding. It is equipped with the B&S Supercise Hydrostatic Headstock as well as the new Hydrostatic Internal Grinding unit. The unique hydrostatic bearings automatically compensate for minute errors.

Roundness to 0.000010" or better, and straightness to a few millionths can be maintained in production runs by average operators, grinding with live or dead centers.

There is practically no limitation on the weight of the holding fixture. Contact wear of the spindles is virtually eliminated, since there is no metal to metal condition under rotation. Precision performance can be maintained through a wear-life at least 10 times that of conventional spindles.

The Supercise Hydrostatic Headstock and Internal Grinding unit are available as extra equipment on any of the four sizes of Universal Grinding Machines. They are the newest of many exclusive features of B&S Universals that permit job-time savings of 75% or more, and make them your best investment for toolroom, prototype, or production grinding. Why settle for less? For full information, write: Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

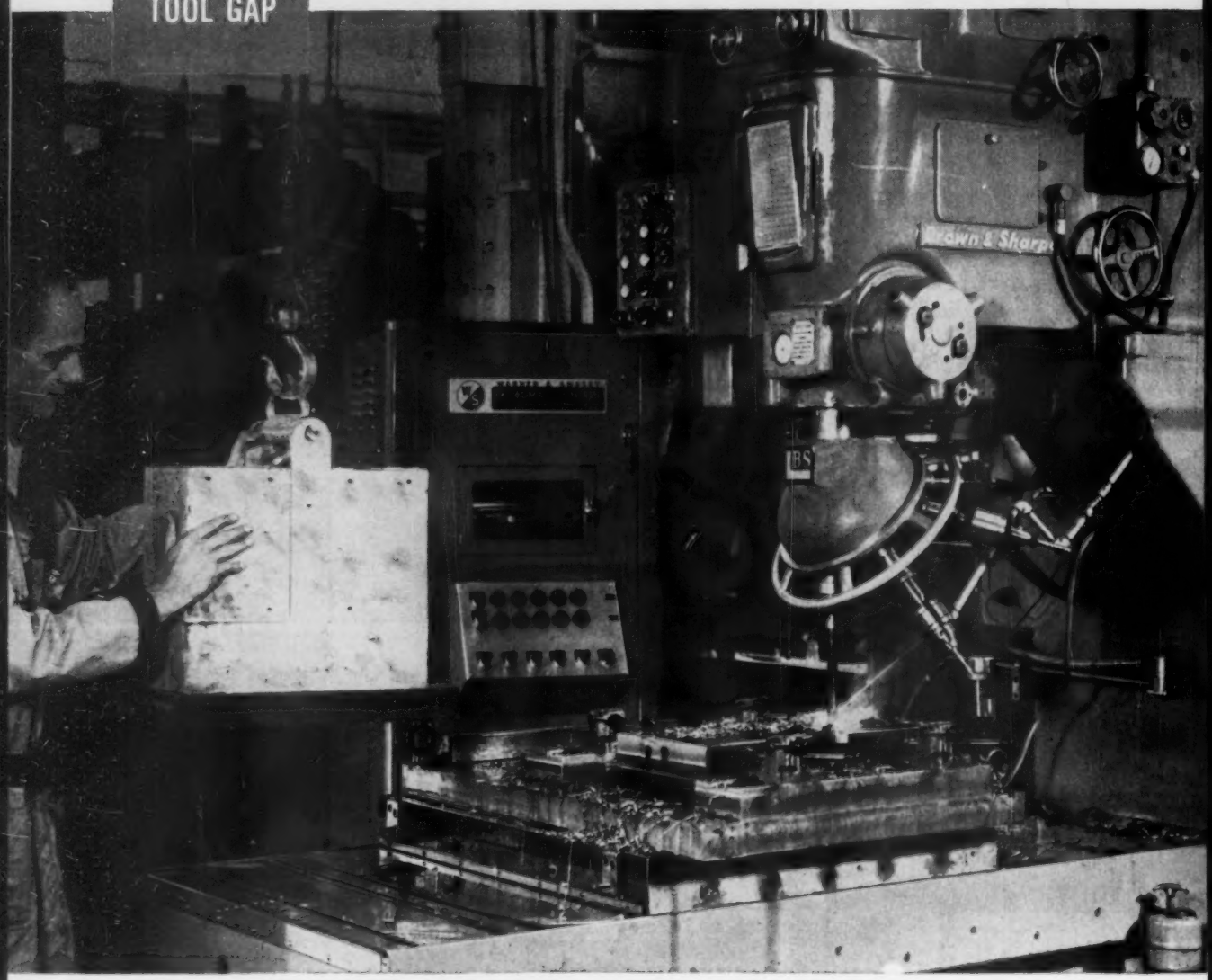
Test chart indicates true roundness well within 10 millionths of an inch.

Brown & Sharpe PRECISION CENTER

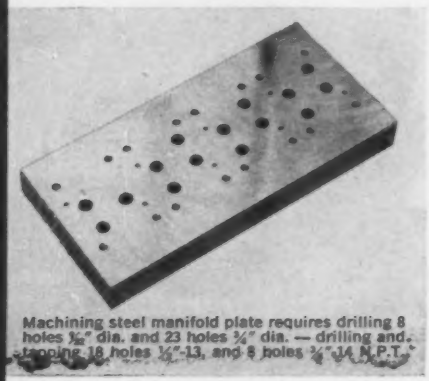
CIRCLE 300 READER SERVICE CARD

Close the MACHINE TOOL GAP

MODERNIZE DRILLING AND MAKE MORE FOR LESS



Twin set-up, automatic drilling on B&S Turr-E-Tape cuts production time 40% - eliminates jig expense



Machining steel manifold plate requires drilling 8 holes ½" dia. and 23 holes ¾" dia. — drilling and tapping 18 holes ½"-13, and 8 holes ¾"-14 N.P.T.

At F. J. Stokes Corporation, Philadelphia, manufacture of plastic molding and other processing machinery calls for numerous short runs of parts for custom built equipment. With Turr-E-Tape, the Brown & Sharpe tape-controlled Turret Drilling Machine, drilling and tapping operations are performed at an average saving of 50% in floor-to-floor time over the previous jig-drilling on a radial drill press.

In the set-up shown, 31 holes are drilled and 26 drilled and tapped in a valve manifold plate, with a production time saving of 40%. The parts are held in simple universal fixtures clamped to the positioning table. With the double set-up, one part is machined while the other fixture is unloaded and reloaded by the operator using a magnetic conveyor-hoist.

Indexing, starting and stopping of tool operations, and accurate hole-positioning are all performed automatically, at the "command" of punched tape in the numerical positioning control.

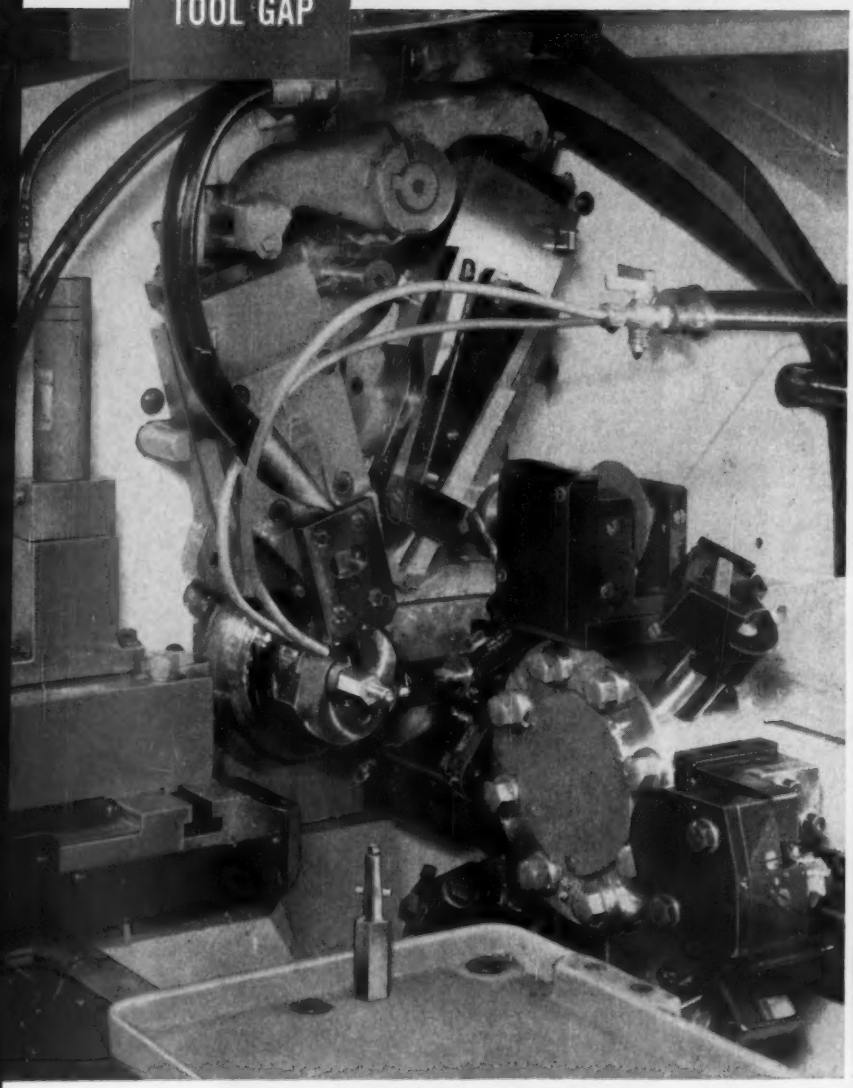
If your production requires numerous short runs, or long runs of parts used a few at a time, find out how much you can save with the Turr-E-Tape... in tooling costs, in non-productive time, in skilled labor costs. Write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

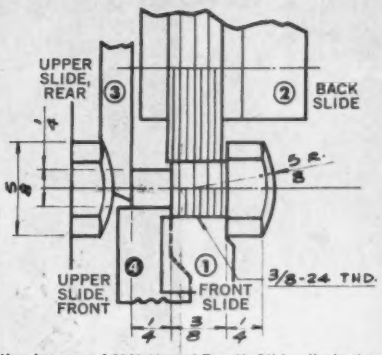
Brown & Sharpe PRECISION CENTER

CIRCLE 301 READER SERVICE CARD

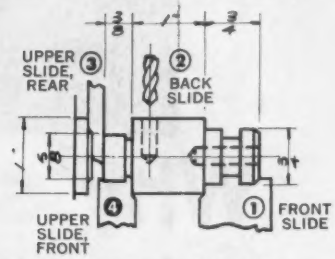
Close the MACHINE TOOL GAP

MODERNIZE SCREW MACHINING
AND MAKE MORE FOR LESS

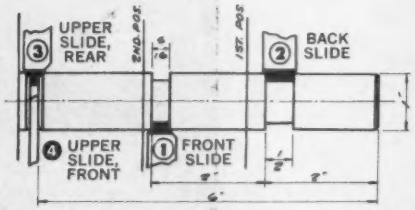




Production increased 25% Use of Fourth Slide eliminates slow swing-tool operation . . . also eliminates wide form tool (1 and 4 combined) on front slide which would not allow thread-rolling due to driving diameter.



Completed in one operation Too long to form complete. Stock diameter too large to use swing tools. Use of fourth slide for forming now permits part to be made in one operation.



Production increased 100% with carbide tools. Length restricts use of swing tool, and of wide form tool. Use of Fourth Slide frees upper rear slide for carbide breakdown of cut-off diameter.

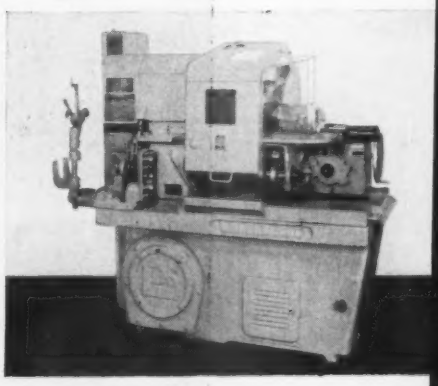
New Fourth Slide attachment permits up to 12 tools on B&S No. 2 Automatics -- saves second operation costs

Now, still more of your screw machine jobs that formerly required expensive second operations can be machined complete from the bar. With the new Fourth Slide, and the 8-hole turret, the No. 2 Automatic can provide 12 cutting stations — four cross slide tools and eight end cutting tools. The main rear slide can now be used for extra operations, such as cross drilling or milling, thread-rolling, marking, or finish forming.

The Fourth Slide is located on the upper front of the machine at an angle. Two tool posts are provided, one for left-hand and one for right-hand turning. They can be interchanged with the upper rear slide post.

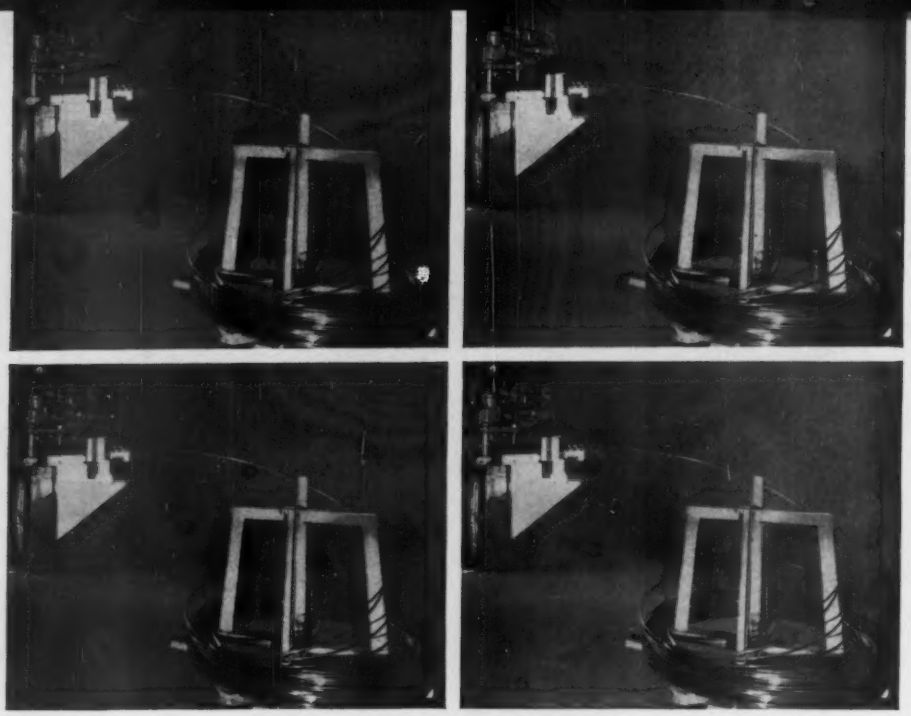
The three jobs shown in the drawings above are typical of thousands for which costs can be substantially reduced with the use of the new Fourth Slide. Production gains are as much as 100% or more.

The Fourth Slide is an optional attachment for B&S No. 2 Automatics now in production. Get complete information. Find out how the many new-design features and attachments now available can help you drive down production costs. B&S Machine Tool specialists will survey your operations at your request, and recommend new set-ups for savings. Write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

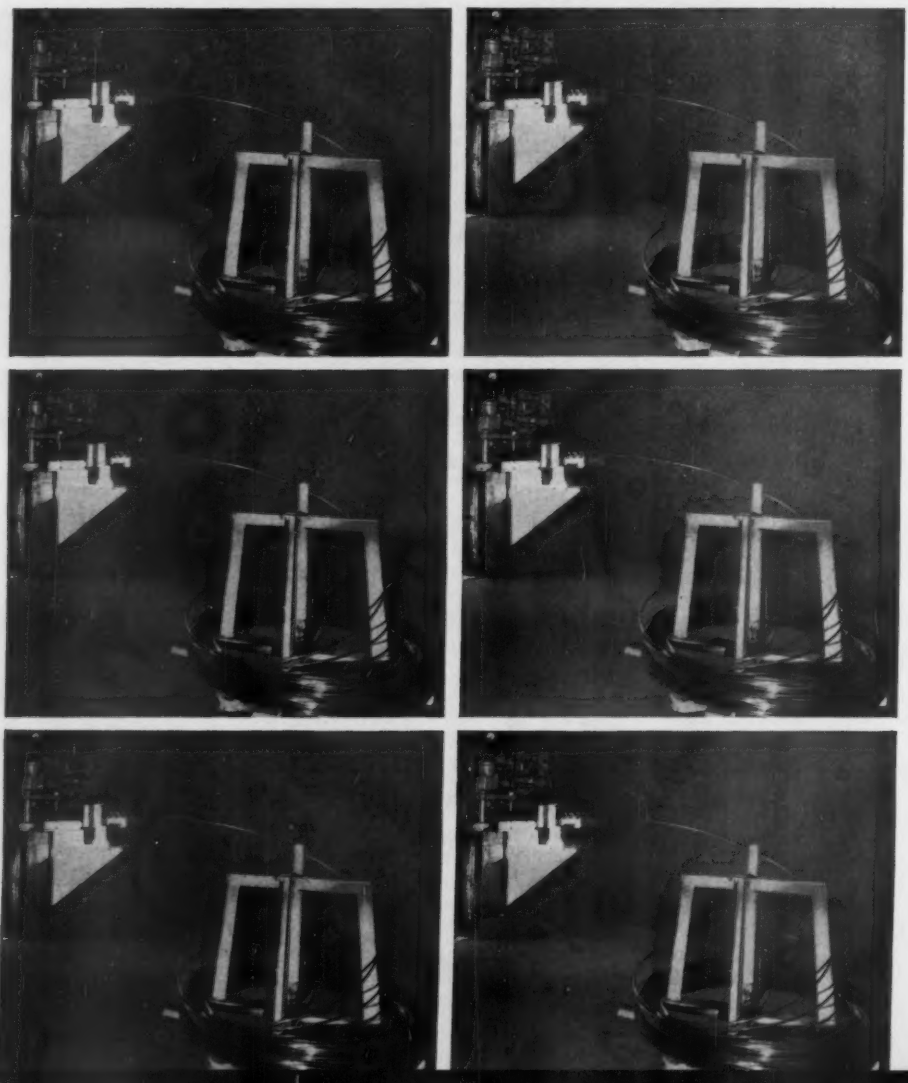


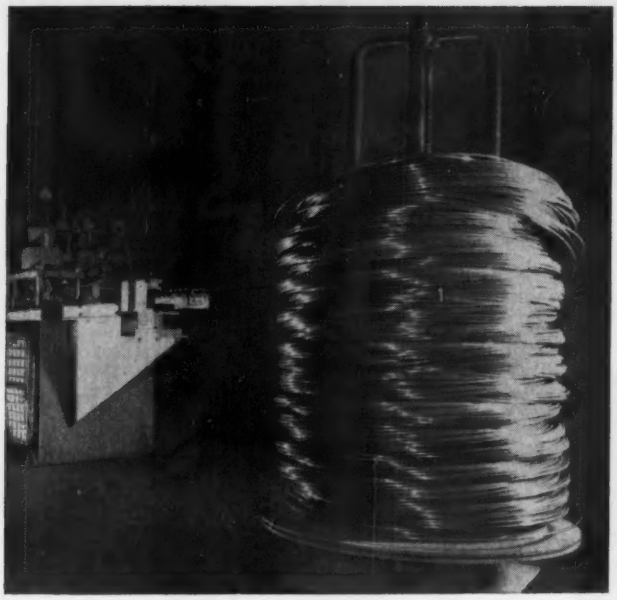
Brown & Sharpe PRECISION CENTER

CIRCLE 302 READER SERVICE CARD



Why set up ten times....





. . . .when once will do?

It's a simple matter to add up the savings heavyweight wire coils can give you. How much time does it take you to shut down a machine and start a new coil through? Multiply that by the number of times you have to do it in an 8-hour shift. Then figure that as much as 90% of that lost time is sheer waste. Because you could be using AS&W heavyweight coils that contain up to ten times as much wire in one continuous length. **Other savings:** less handling, less storage space needed, even lower scrap loss. Heavyweight coils aren't the only road to cost reduction: *American Steel and Wire offers a dozen different wire packages.* One of them is designed just right for your operation. Let us look at your set-up and recommend the best package . . . a simple step to increased production. Call our nearest sales office or write American Steel and Wire, Dept. 1492, Rockefeller Building, Cleveland 13, Ohio.

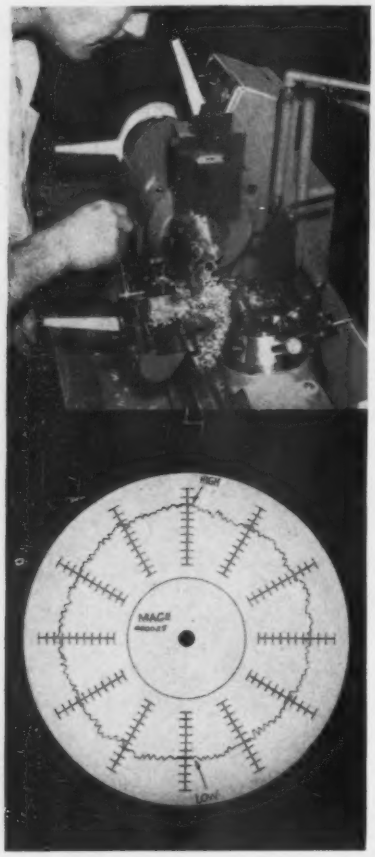
Innovators in wire

American Steel and Wire
Division of
United States Steel

Wade

model 94 LATHE

Built with 1 1/16" collet capacity and 9" swing, this electric clutch hand turret lathe releases large machines from bar work and from second-operation work that can be performed more economically on this size lathe. Perfectly suited, for example, to the type of exacting work that is required on a potentiometer case. Distance from spindle to turret face (max.) 17"; spindle speeds 140 to 3500, infinitely variable.



Can your lathe do this?

- Turn round to 25 millionths
- Turn to a √5 finish
- Hold concentricity .0002" on 5 or 6 diameters
- Perform 7 distinct operations at one chucking

COVEL MANUFACTURING CO.

BENTON HARBOR, MICHIGAN

LETTER from the PUBLISHER

The Profit In It

In our October 30, 1961 issue we published a special report to metalworking: **How To Prove The Profit In Numerical Control.** Numerical control has been available commercially on machine tools for about seven years. (It was first reported to you by editors William M. Stocker, Jr. and Charles D. Emerson in a special report titled: **Numerical Control: What It Means To Metalworking,** *AM/MM*, October 25, 1954.) Today it has come into its own.

Thirty percent . . .

Estimates vary but most authorities agree that within five years 20% to 30% of the cutting type machine tools sold in this country will be numerically controlled. This does not mean that numerical control is any panacea. After all, numerical control is simply the extension of a man's muscle power.

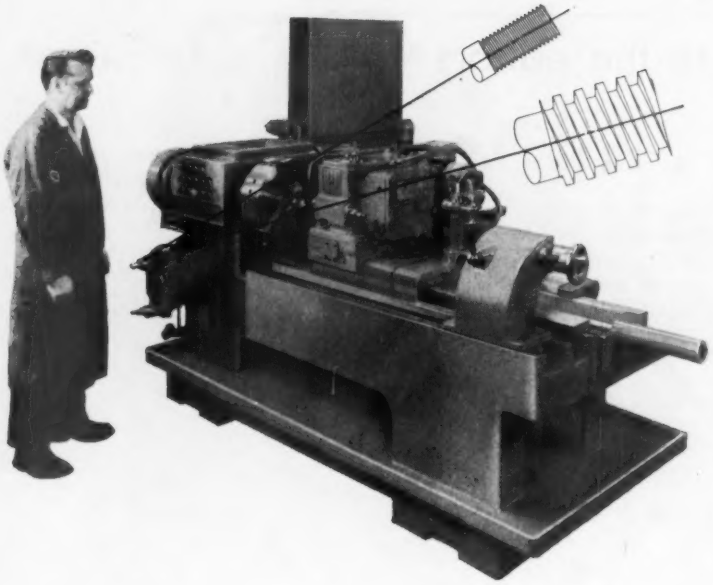
The major application for numerical control is in short-run production. It's major saving is time: time in designing jigs and fixtures, time in production planning, set-up time and other labor time, etc. It offers savings in other areas. The special report in our October 30 issue deals with the economic justification of numerical control: what you get back for a dollar invested. Just as automated lines and high production machines mean cost savings for long runs, so numerical control shows economies for short runs.

A competitive weapon . . .

For manufacturers faced with increasing pressures for higher wages in the face of mounting competition, numerical control where it applies, can be an effective weapon. It can sharply reduce both the direct and the indirect cost of your product; can help you to compete more effectively; can increase your profit. If you'd like a copy of our October 30 special report: **How To Prove The Profit In Numerical Control,** please write me. It is available at a nominal price: 75¢.

George Reppert

AUTOMATIC THREAD MILLING



Sine bar adjustment...simple dial setting...fully automatic cycling speed production on parts like these

Typical work shown above and below includes a wide variety of parts, such as lock nuts, steering gear worms and nuts, injector cups, aluminum studs, electric motor shafts, jet engine components, etc.

Check these important benefits of Sundstrand thread milling

- Mills internal or external threads . . . right- or left-hand . . . straight, tapered, or special . . . on straight or interrupted work surface, such as splines, key slots, and flutes.
- Makes external threads one pitch away from a shoulder . . . internal threads one pitch from bottom of a blind hole.
- Accurately relates pitch diameters to other elements of the workpiece.
- Mills threaded and plain diameters simultaneously.
- Simultaneously mills two threads of the same pitch and lead on the same or different diameters.
- Threads workpieces of various diameters with a single cutter.
- No special operator skills are required to consistently produce tolerances and finishes finer than normally obtained with single-point tools or taps and dies.

Here's an automatic thread milling machine that provides high production and precision accuracy on a wide range of threading operations — including those too difficult, costly, or impractical by other methods. This machine uses multiple thread cutters with the desired pitch and thread form *but without lead*. Exclusive dial-adjustable sine bar mechanism provides an infinite range of thread leads from 0 to ½".

There are no gears or cams to change for different thread leads, so changeover is simplified. Fast, five-minute setup makes the machine ideal for short or long runs. Fully automatic machining cycle plus inherent machine accuracy and simplicity of adjustment eliminates the need for special operator skills. High-quality, consistently uniform threads are readily produced to exacting military and aircraft specifications.

Four standard models handle workpiece length up to 24", 48", 72" and 96". A wide selection of optional attachments is available to speed production and increase the versatility of these machines.

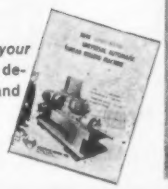
SUNDSTRAND

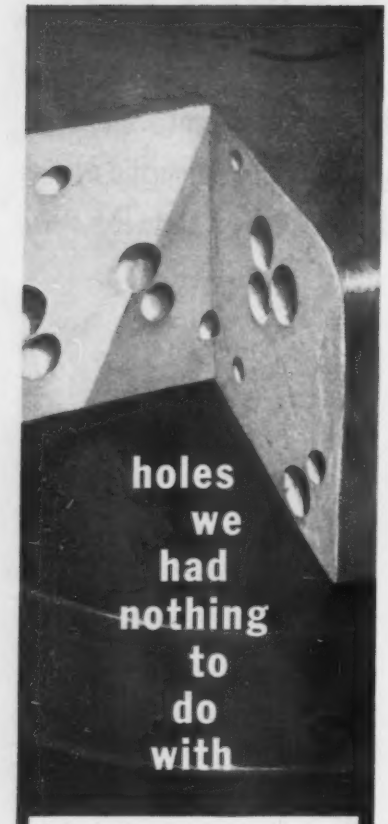
SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS

Division of SUNDSTRAND CORPORATION

The machines to improve *your* threading operations are described in a new Sundstrand Bulletin No. 634-1. Write for a copy today.

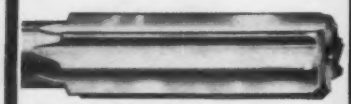




Not these, of course. But holes that L&I reamers do have something to do with are precision, properly-sized holes in metal. Because there is such a complete line of L&I reamers, your selection is greater, allowing you to choose exactly the right reamer for your particular job requirements.

Your nearby L&I Distributor stocks a full line of reamers. Call him today for fastest service.

NEW! HLB ECONOMY STUB REAMER. The first economy reamer for automatic screw machines is fully described with sizes available in new 4 page brochure. For your FREE copy, see your distributor or write



L&I

LAVALLEE & IDE, INC.

"THE REAMER SPECIALISTS"

CHICOPEE, MASSACHUSETTS

LETTERS

to the editors

330 W 42nd St, New York 36, NY

N/C Cover Point

Dear Sirs:
The design is a block of information using the binary coded system and decoded spells N C PROFIT. If I am not one of the first six people writing to you abcut this please te'l me how I can get a copy of the book "Numerical Control for Metalworking Manufacturing."

William L Potter
Equipment Development Engnrg.
General Electric Co
West Lynn, Mass

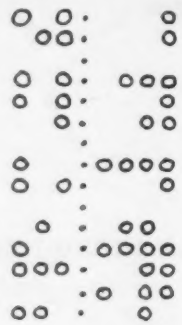
Reader Potter gets a copy (see page 111 for list of other winners). If you want a copy of the book it can be ordered from Readers Service Department, AM/MM, 330 W 42nd St, NY 36, NY. The price is $1—Ed.

Dear Sirs:
The cover design (*AM/MM*—Oct 30 '61) stands for: N (Numerical) C (Control) Profit Return, meaning that with the intelligent, correct, and timely application of *Numerical Control* to metalworking requirements, *Profit Return* will result in the form of lowered total cost of manufacture.

Jack D Selkin
Branch Engineer, M-14 Rifle
Boston Ordnance District
Boston, Mass

We couldn't have described it better ourselves—Ed.

Dear Sirs:



E W McClurken
Plant Engineer
Stokes Corp
Philadelphia 20, Pa

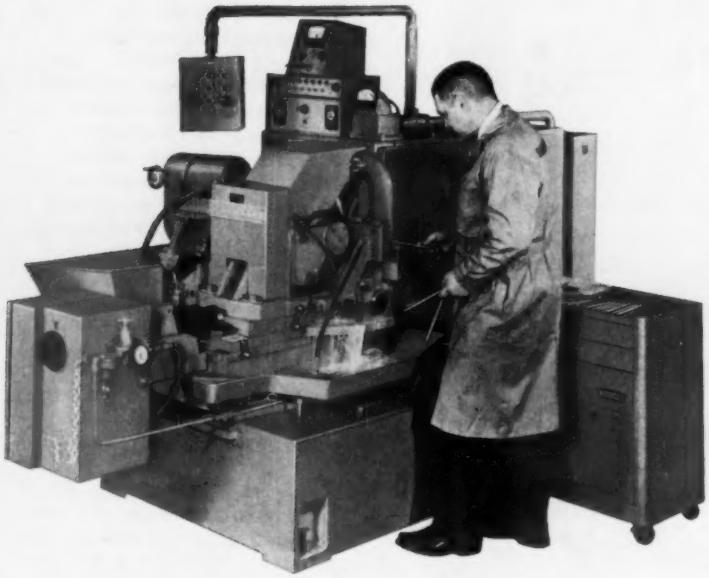
We agree.—Ed.

(continued on page 60)

SHOPMATES

N. Jarvis

CENTERLESS BELT GRINDING



Only centerless abrasive belt grinding gives you these 11 BIG advantages...

- Fast stock removal . . . up to 3 lbs. per minute at feed rates from 2 to 70 feet per minute depending upon application.
- Reverse feed mechanism — through feed grinding in either direction virtually eliminates nonproductive time on reciprocal cycle or multiple-pass work.
- No wheel truing or dressing — low-cost abrasive belt is ideal throw-away tool — requires no balancing, provides constant surface speed.
- Cooler operation — large grinding area and long belt reduces and dissipates heat — less cutting pressure on smaller chips eliminates dimensional distortion.
- Improved cutting action — flexing works out chips for better cutting edge exposure
- Interchangeable rubber-covered contact wheel — backs up the belt, eliminates chatter, and compensates for stock irregularities which are difficult to grind with hard wheels.
- Fast Change-over — complete setup takes only minutes, reduces downtime.
- Low initial cost—low installation cost.
- Simple operation — eliminates the need for highly skilled labor.
- Optional automatic size control holds tolerances as close as ±.0002" T.I.R.
- Built-in coolant system standard on all machines.

Sundstrand-Engelberg machines offer many opportunities for lower cost centerless grinding of cylindrical work. The belt grinding principle provides exceptionally rapid stock removal . . . up to 3 lb per minute. It speeds production because on many jobs it is up to eight times faster than other methods.

Abrasive belt grinding introduces many new economies. Setup and fixturing are simplified. Low cost, flexible belts are the ideal throwaway cutting tool . . . never need truing or dressing and changeover takes only a few minutes.

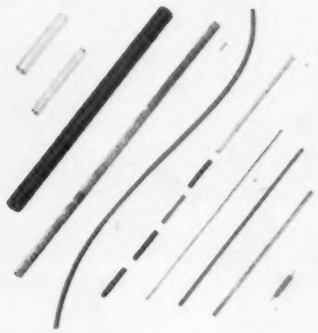
For tool room, small lot or high production work, Sundstrand-Engelberg centerless abrasive belt grinders cost less to buy, less to install, less to operate . . . and no machine produces finer finishes and accuracies faster or more economically.

Sundstrand-Engelberg centerless abrasive belt grinders are available in 3 to 75-hp models for cylindrical work from 3/32 to 12" in diameter. All machines can be equipped with tandem heads for ruff, semifinish, and finish grinding in a single pass.

SUNDSTRAND

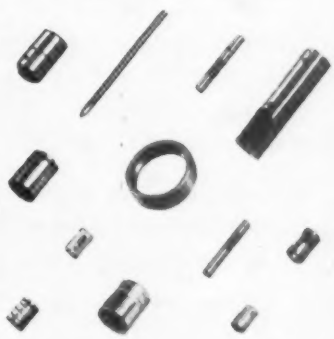
SUNDSTRAND MACHINE TOOL
BELVIDERE, ILLINOIS
Division of SUNDSTRAND CORPORATION

Precision method for faster stock removal on parts like these



Seamless tubing • Shafting
Rubber hose • Ceramic resistors

Springs • Glass and plastic rod and tubing • Rotor shafts
Serrated cylindrical parts



Bearing races • Piston rods
Socket wrenches • Atomic fuel elements • and hundreds of others

The many cost-saving benefits provided by Sundstrand-Engelberg centerless abrasive belt grinders are outlined in a new four-page Bulletin No. 634-2. Write for your copy today.

VK

THREAD GAGES

COMPLETE LINE . . . including Thread Plugs, Thread Rings and Truncated Setting Plugs.

Conforming to H28 Screw Thread Standards, these gages are made under the most modern manufacturing and inspection facilities . . . eliminating all questions about size, lead, drunkenness, and angle.

Exceptional surface finish and geometry; — pitch diameters checked with VK Calibrated Thread Measuring Wires . . . all combine to give unparalleled quality. *Long gage life is assured.*

Send for new Catalog 36B

THE VAN KEUREN CO.
173 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS . . . rated the world's most accurate
• Optical Flats and Light Wave Equipment • Gage Blocks
Precision Lapping Service and Parts • Plug Gages • Measuring Wires
WA 6-1450

Faster Form Grinding

Dear Sirs:

We appreciated the fine account of our new form grinder for rod mill rolls (*AM/MM*—Oct 16 '61, p164), except for one thing.

This machine does the operation four to five times faster than turning, not in 20 to 25% less time, as your story stated.

On rereading our release, I realize that it could perhaps be interpreted either way. And I took one of those courses in clear writing, too!

I can understand why a staff member rewriting the release to fit the space needs of your "New Shop Equipment" section might have felt there was an error in our release. After all, not many machine tools can claim to improve productivity four to five times over former methods.

However, this is an example of Abrasive Machining where such surprising improvements in production are becoming quite common.

Roger N Perry, Jr
Norton Co
Worcester, Mass

We did misread the Norton announcement; we apologize—Ed.

We Built It

Dear Sirs:

A paragraph in a recent Spot News Trend section (*AM/MM*—Oct 16 '61, p79) was somewhat in error. The Advanced Products Department of General Dynamics developed the electro-hydraulic metalforming machine that you credit as a development of Electro-Hydraulics, Inc of Dallas and Fort Worth. While Electro-Hydraulics has done, and is presently doing, valuable work in the advancement of this process, we would like to point out that the concept and principle of this equipment is the Advanced Products Department's Hivopak electro-hydraulic metalforming machine.

We feel certain that everyone concerned would be interested in this distinction being made, for clearer identification in the future.

Judd Graham
Advertising Manager
Advanced Products Dept
General Dynamics Corp
San Diego, Calif

We described the General Dynamics Hivopak Apr 18 '60, p104. Also see page 100 of this issue—Ed.

CALENDAR

Society of Automotive Engineers —Annual Meeting and Display, Jan 8-12, Cobo Hall and Convention Arena, Detroit, Mich.

Joint National Symposium on Reliability and Quality Control, Jan 9-11, Statler Hilton Hotel, Washington, DC.

Society of Plastics Engineers— Annual Technical Conference, Jan 30-Feb 2, Penn-Sheraton Hotel, Pittsburgh, Pa.

Material Handling Institute — Spring Meeting, Feb 6-8, Hilton Inn, Atlanta, Ga.

American Society for Metals — Golden Gate Metals Conference, Feb 15-17, Fairmont Hotel, San Francisco, Calif.

Society of Automotive Engineers — National Automobile and Production Meeting, Mar 12-16, The Sheraton Cadillac, Detroit, Mich.

Pressed Metal Institute—Spring Technical Meeting, Mar 14-16, Commodore Perry Hotel, Toledo, Ohio.

Society of Automotive Engineers —National Aeronautic Meeting and Display, Apr 3-6, Hotel Commodore, New York, NY.

American Welding Society—43rd Annual Convention and Exposition, Apr 9-13. Technical Meetings, Sheraton Cleveland Hotel; Welding Show, Cleveland Public Auditorium, Apr 10-12, Cleveland, Ohio.

American Foundrymen's Society —Castings Congress and Exposition, May 7-11, Cobo Hall, Detroit, Mich.

American Institute of Industrial Engineers — National Conference, May 17-19, Ambassador Hotel, Atlantic City, NJ.

Society of Automotive Engineers —Summer Meeting, June 10-15, Chalfonte-Haddon Hall, Atlantic City, NJ.

American Society for Testing Materials — Annual Meeting and Exhibit, June 24-29, Statler Hilton Hotel, New York, NY.

PATRONIZE YOUR LOCAL STEEL SERVICE CENTER!

STEEL SERVICE CENTER INSTITUTE

It's the easy, economical way to meet your cold finished steel requirements—promptly and efficiently.

Your steel is delivered to your plant when you want it... as you want it... large or small quantities... special rush deliveries when needed to keep your production on schedule.

Get to know your local steel distributor —he can save you time and money.

Wyckoff Steel supplies many of the major steel service centers with a wide variety of controlled quality, cold finished steel bars. For the best results

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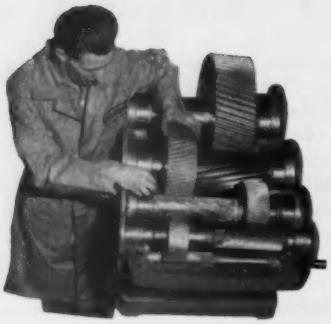
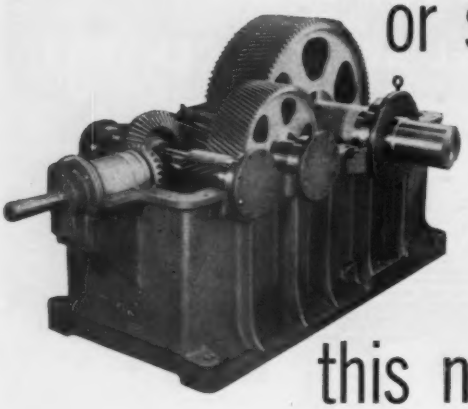
WYCKOFF STEEL COMPANY

GENERAL OFFICES:
GATEWAY CENTER, PITTSBURGH 30, PA.
WORKS: AMBRIDGE, PA.—CHICAGO, ILL.
NEWARK, N.J.—PUTNAM, CONN.

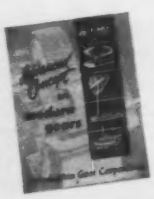
If you need gear drives that can deliver more power in less space... reduce vibration



or sound levels... or operate at higher speeds yet last longer... look for this nameplate.



It means that drive gearing has been hardened and precision ground to give radically improved gear accuracies. Yet they cost no more. For full details...

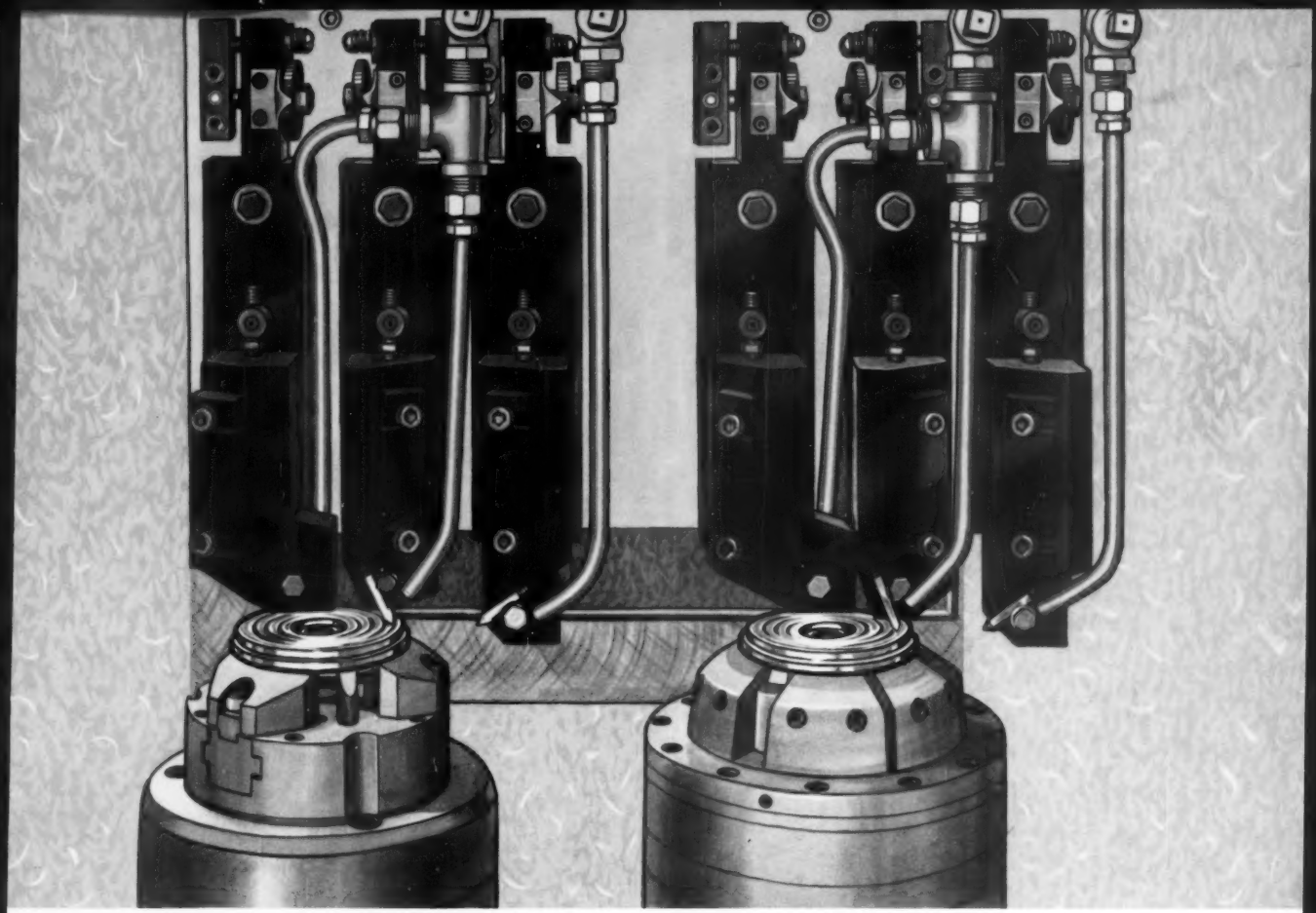


write on your company letterhead for "An Advanced Concept in Modern Gearing"

AGMA
MEMBER

PHILADELPHIA GEAR DRIVES

PHILADELPHIA GEAR CORPORATION
King of Prussia (Suburban Philadelphia), Pa.



New Britain's new concept for contour turning and boring

Beyond a certain point, continued refinement of existing designs in machine tools ceases to make an appreciable contribution to performance. Thus in designing our New Series of Vertical Precision Boring Machines, we have incorporated several completely new design concepts to provide improved performance and greatly increase over-all usefulness.

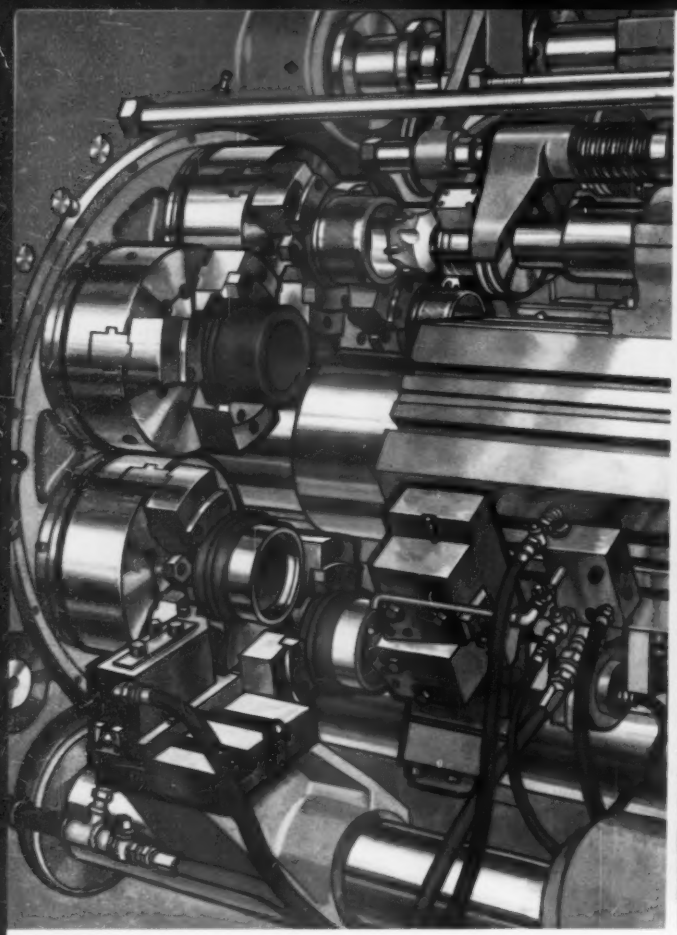
For the first time machines of this type can be used as building block units. Their clean-sided design permits any number of self-contained machines, each with one or more spindles, to be arranged side by side and operated as a single unit. They also may be operated with equal efficiency as individual machines. Parts can be inverted on adjacent machines or on adjacent spindles of the same machine.

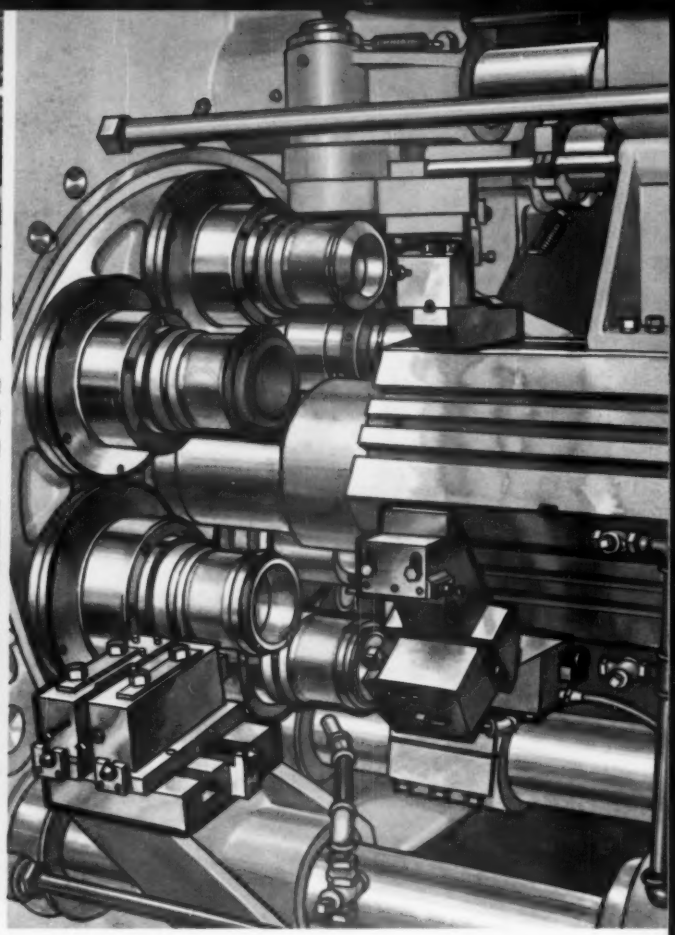
In order to take the fullest advantage of the precision inherent in cam control, long linkages between cams and slides have been eliminated. A pair of cams is mounted on a common shaft which is carried *within the vertical slide.* Since all slide actuating forces are contained in the vertical slide, both cams are directly adjacent to the slides they control and no outside forces are imposed on the slide ways. The result is maximum rigidity for heavy cuts coupled with extreme accuracy for close tolerance work.

This unique and eminently workable approach to contour turning and boring results in the highest order of accuracy on even the most complex pieces. Your New Britain Representative can give you details on the nine different models available in this series. For catalog material, write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Conn.

THE NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division - New Britain, Connecticut





New Britain . . .
still the best Chucker you can buy

We're not unhappy about the fact that for years, in many plants, the name New Britain has been synonymous with chuckers. New Britain Chuckers have turned out literally millions of pieces of work for practically every major industry in the world. This is less important to the prospective buyer of one of these machines, however, than the capabilities of these machines today. How do they stack up against other chuckers or even other types of machines capable of doing similar work? Pretty well, we think.

New Britain's open-end design still can't be beat for unlimited accessibility to the tooling area. This same wide-open feature makes it doubly more practical to adapt these machines to automatic loading and unloading.

The unusual combination of longitudinal and transverse forming motions is another unbeatable New Britain feature. The massive forming arms on New Britain Chuckers allow heavier cuts and cuts of much greater complexity. This ability to do more work can eliminate the need for second operation machines in many instances. For really complex work, two chuckers set up side by side, as shown here, each doing one side of the piece, can smooth the way for high production. Less complicated work can be set up to perform both sides of the same piece on a single machine.

These massive machines provide the tooling combinations, spindle speeds and power to perform the widest possible variety of work. Their basic design will stay new for years to come, continuing to provide profitable operation. You may know New Britain Chuckers, but you may not be fully aware of the improved series presently being offered. Why not call your New Britain Representative or contact us at The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division · New Britain, Connecticut

SPOT NEWS...

- **Depreciable lives of 5 to 10 years for machine tools,** as a substitute for much longer lives now contained in Internal Revenue Service's Bulletin F, are being recommended to Treasury by the NMTBA's board of directors. The board also has gone on record in favor of an across-the-board tax credit plan as well as faster depreciation, feeling that both are necessary to stimulate investment in capital goods. Full report on annual NMTBA meeting starts on p91.

- **Naval Research Lab reports that it has been able to produce rhenium sheet** by a process including arc melting, pressing, and cold rolling. Despite its high melting point, rhenium (one of the newer high-temperature materials) was melted quite easily at 500 amps, 25 volts. Cold working wasn't as simple. Multiple small reductions were called for, each followed by a stress-relief anneal at very high temperature in a very pure environment.

- **Third annual Nonferrous Metal Powder Part of the Year competition** begins Dec 1, with parts made from any copper-base powder now eligible. New Jersey Zinc Co, the sponsor, is offering a top price of $1000, split equally between the fabricator and his customer. Contest closes March 1, 1962. For entry blanks write to C R Maxon, New Jersey Zinc Co, 160 Front St, New York 38, NY.

- **In an effort to find export markets for Indian machine tools,** M K Mathulla, chairman of Hindustan Machine Tools, Bangalore, India, is presently traveling in Europe, enroute to the United States. The company recently received its first order from West Germany, an order for about $20,000 of machine tools.

- **The administration's 8% tax-credit plan has been criticized** by the chairman of the tax committee of the National Association of Manufacturers, Roland M Bixler. He asserts "the plan favors currently expanding firms at the expense of companies that have done a good job of modernization, expansion, and job creation in previous years," and that such a tax break "would simply make it more difficult for others to compete for the available capital supply."

- **What is reported to be the largest testing machine** in a commercial facility has gone into operation at Pittsburgh Testing Laboratory. The 1,200,000-lb-capacity Tinius Olsen Super "L" universal testing machine has vertical clearances of 15 ft 6 in. in tension and compression, and 62-in. horizontal clearance between screws. (The National Bureau of Standards still uses a 10,000,000-lb-capacity unit built by Tinius Olsen in 1912.)

- **Gross National Product will climb 5-8% next year according to estimates** put forth at the National Industrial Conference Board's meeting in Detroit. Machinery sales will rise modestly (see page 73); steel production will increase gradually, and profits will be squeezed tighter than ever; and the television-appliance industry should be up about 8%.

- **In hopes of increasing its machinery exports to the US,** the Japanese held a "Light Machinery Show" in New York, Nov 10-22. Among the exhibits were a precision milling machine (Copal Koki Co, Ltd, Tokyo); reamers (Hikari Seiko Co, Ltd, Kyoto); taps (Ooka Seisakusho Co, Ltd, Tokyo); dial gages (Ozaki Mfg Co, Ltd, Tokyo); and many other hand tools, gages, indicators, and merchanical and electronic equipment.

- **Verson Allsteel Press Co (Chicago) has announced a seven-year lease plan** for its complete line of press brakes, hydraulic presses and shears. Leases will be available for as little as $10,000 worth of Verson equipment. Program is being underwritten by Nationwide Leasing Co, Chicago. (*AM/MM*—Nov 13 '61, p122.) Plan is available to all companies with good credit standing and not restricted only to larger firms. Purchase options are also available.

There's a Full Tool Steel Warehouse
Behind the A-L STEELECTOR Cards!

The pocket-size STEELECTOR Cards represent a full tool steel warehouse—full of the grades and shapes and sizes.

Each STEELECTOR Card (there are cards for hot work, high speed, and tool room applications) uses bar graphs to show how the STEELECTOR grades compare in abrasion resistance, toughness, size stability, machinability, and red hardness. In a glance you can select the grade with the best combination of properties for virtually any job.

And when you select a STEELECTOR steel, you know beforehand that it is quickly available. Warehouse supplies have been increased because of the widespread usefulness of STEELECTOR grades.

A Data Stock List for each STEELECTOR grade gives you additional information—to help you make sure that the steel fits your job exactly. The steel's properties are described and the proper hardening, tempering, and annealing temperatures are given along with the steel's analysis and AISI number. A list of typical applications together with suggested working hardnesses serves as an additional check on your use of the steel.

The Data Stock List also tells exactly what sizes and shapes are in warehouse stock. You know before you order that the tool steel you choose is ready for prompt delivery.

By using STEELECTOR grades, you can save storage space in your own plant. You can reduce the number of grades you stock. And you can rely on fast off-the-shelf delivery in case your own stock runs low.

For more information on the STEELECTOR system, ask your Allegheny Ludlum representative for your copy of the colorful, 10-page STEELECTOR Booklet, or write: ***Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania.*** Address Dept. AM-11. 3240

STEELECTOR PROGRAM

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country

WASHINGTON...

Freer trade policy?

In the face of increasing protectionist sentiment in many hard-goods industries, the Kennedy administration is drafting a freer trade policy which could result in more tariff reductions and a greater rate of imports into the US. But the new policy also has implications for US exporters—the likelihood of more favorable markets abroad for domestic goods.

The White House has just about decided not to seek renewal of the Reciprocal Trade Act next year. Instead, the President wants broad authority to offer reciprocal tariff reductions on wide categories of industrial goods rather than on an item-by-item basis. Administration planners want to judge the mood of Congress, however, before deciding the degree of tariff-cutting authority to request—whether it should go down to zero, for instance.

The President also wants authority to bargain directly with nations outside the European Common Market on a variety of goods of special interest to them. Congressional leaders think Kennedy has a chance to get much of the additional authority he seeks, but it's likely the fight may take as long as two years.

Common Market stirs changes . . .

The emergence of a unified European economy has brought the issue of US trade policy to a head. As administration planners now see it, there will be two super economies—not just the US—dominating the free world in the years ahead. Together, Western Europe and the US will control about 90% of the free world's industrial trade.

The Administration has decided that cooperation rather than cut-throat competition is the way to cope with this.

Trade fair assistance . . .

Commerce Department is now equipped to offer detailed marketing data, information on licensing and financial requirements, and the like, for US firms interested in participating in trade fairs abroad. Before, Commerce would accept US equipment and machinery exhibits for the fairs, running the exhibits for companies and paying all expenses. The exhibition service still stands; now the marketing aid is being thrown in, too.

This month, the US is participating in a big trade fair in New Delhi which is angled to fit into India's current five-year plan calling for emphasis on heavy machinery and capital goods. This will last until January.

Some 17 US fairs are lined up for 1962. About 1,500 US industrial and commercial exhibitors are expected to participate. For information, contact office of International Trade Fairs, Bureau of International Operations, Commerce Department, Washington 25, DC.

New twist to East-West trade . . .

A Congressional trade consultant, Samuel Pizar, has proposed a new approach to US policies on East-West trade. His proposals are made in a special report to the Joint Congressional Economic Committee and are believed to reflect administration thinking on this controversial issue.

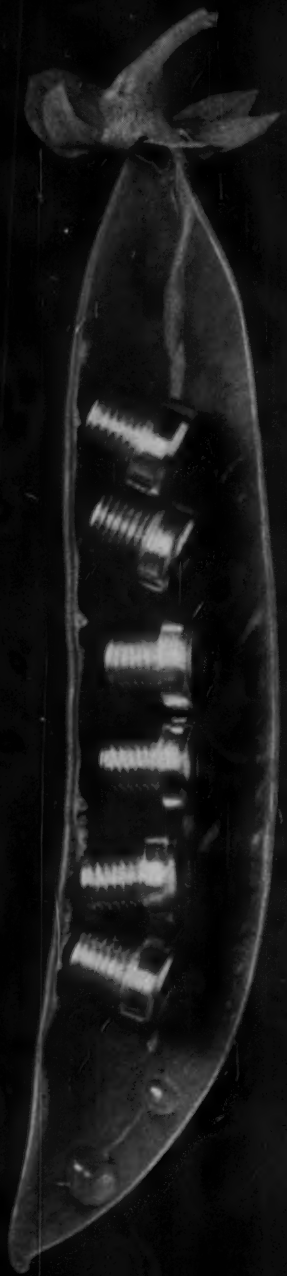
Pizar takes a dim view of current Congressional efforts to impose stricter criteria for curbing US exports to the Soviet bloc. He says US trade behind the Iron Curtain is now negligible, and that what we don't sell the Soviets will be sold by Western European suppliers.

Pizar wants the President to have a free hand to work with US allies for a common and flexible East-West trade policy. He would also broaden the frame of reference from militarily strategic goods to cover any economic transaction with the Red bloc. Such a common approach would have to be accompanied by a radical freeing up of trade within the West and by common Western policies for economic growth. Pizar believes Khrushchev has reversed to a significant extent Stalin's policy of economic self-sufficiency and that East-West trade is more important to the Soviet bloc than it is to the free world.

Aluminum imports . . .

Domestic aluminum producers and fabricators have proposed a plan to minimize the impact of increasing aluminum imports. The industry says it doesn't want direct high tariffs. Instead, it seeks government aid to get aluminum exporters to voluntarily hold sales to the US pegged to "best year" records to date. Foreigners would get to supply part of the metal to meet increased consumption in the US but on a regulated yearly percentage basis.

In addition, the industry plan would (1) promote increased US aluminum ingot exports by government negotiation with other countries which cannot supply themselves adequately but which have rigid restrictions against raw metal imports: (2) seek a higher "Buy American" differential for government procurement.



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DETROIT...

Auto output simmers down . . .

Car production is settling down from the usual fall post-new-model rush, and most builders are starting to find steady production levels. Total domestic passenger-car output for the first two weeks in November was 305,000 units, which converts to an annual rate of 7.6 million. **Chances are very good** that this level won't hold up long, because many dealer inventories are getting filled up, and the first blush of novelty is starting to wear off. There are plenty of nervous times around Detroit, but the present period is touchy because the manufacturers are about to get their first solid indication of whether their cars are going to go well this year or not.

One interesting note is in the luxury field, which has recently been doing unusually well. Chrysler's Imperial has jumped from a recent average of about 500 cars per week up to 800 in the second week in November. Cadillac also pushed up production from a recent average of around 3800 to 4500 per week. Lincoln, however, has been fairly steady at around 1100 a week.

The new compacts are mostly still climbing. Ford's Fairlane, in production since mid-October, reached 4000 per week in mid-November and is still climbing. The Mercury Meteor has been in mass-production assembly only since early November, and total output is not yet very high. Chevy II got up to almost 6000 assemblies per week in early November, then dropped off just a bit. At the same time, Corvair assemblies dropped off a bit. Ed Cole's prediction that Chevy II will outsell the Corvair shows signs of coming true.

Happy with your foreign car?

Half the people who bought imported cars in '56, '57, and '58 still own them, according to a recent survey by the National Automobile Dealers Association. And half of those who traded off their imports are now driving newer imported cars. The remaining car buyers, evidently disenchanted with the imported-car idea, have split just about even between domestic compacts and domestic standard-size cars.

The main reasons why some 24% of those surveyed have switched back to domestic cars are revealing. The big reason was to get a larger car; but right behind this factor were two you might guess: repairs were too difficult to get, and too many repairs were required. The group that traded off foreign cars for full-size US makes was big on mentioning "uncomfortable riding" as a supporting reason.

In contrast, those who still own the same imported car say riding comfort is fair or good (96%), economy is good (91%), ease of handling is good, (96%), and that repairs have been neither immoderately expensive (88%) nor immoderate in the amount of work required (91%).

Half of those who still drive imported cars, but not the same ones bought in '56 through '58, have the same make; and 62% of them said the reason was that they wanted a new car. Those who have a different make of imported car were more split up in their reasons; 38% wanted a new car, 26% needed a larger car, and a total of 27% mentioned repair problems.

All of those surveyed were asked about the more important factors they'll think about when they buy their next car. They cited operating cost (56%), quality (54%), gasoline economy, performance, handling, cheap repair, low purchase price, riding comfort (30%), and so on. Attractive appearance rated 19%, and roominess 14%.

Exports (new style) . . .

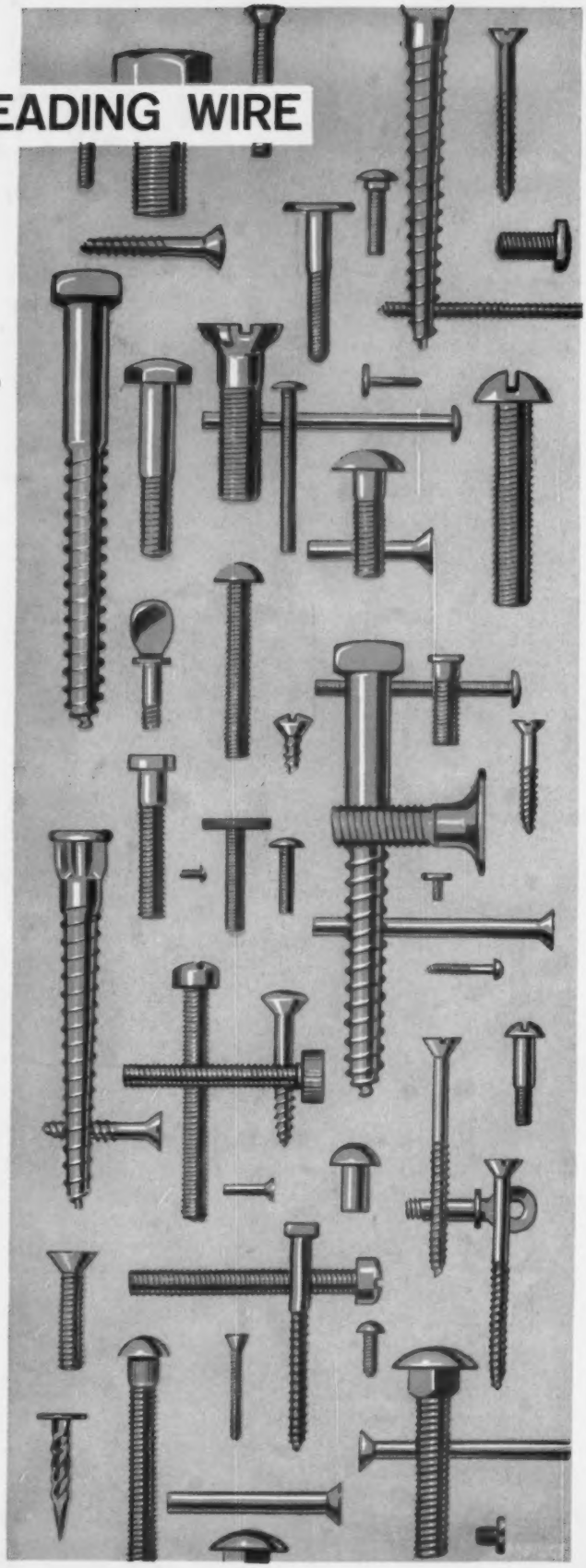
Sales abroad for US carmakers have been going from bad to worse in late years, possibly because the cost of a US car delivered abroad is often little short of astronomical. But two local carmakers have been doing fairly well with KD (knocked-down) units. These are unassembled cars shipped in boxes that include various quantities of the parts required for each completed car. Some foreign countries (one is Argentina) require that a given percentage of the car must be built locally.

Willys has affiliations with 13 foreign manufacturing plants (Taiwan, Israel, Japan, South Africa, Turkey, among others) and with 13 assembly plants (Chile, Cuba, Denmark, Indonesia, Nigeria, among others). Jeep trucks, in various versions, are the mainstays, of course. In total, all these overseas plants produce almost as many vehicles as does Willys in Toledo. In 1960 Willys assembled 63,500 vehicles at home, and shipped the equivalent of 59,000 vehicles abroad.

American Motors has much the same agreement with plants in Mexico (Willys Mexicana), Malta, Australia, South Africa, and New Zealand. Parts shipped KD are mainly for the Rambler Classic. Production outside the US is about 18,000 units per year, including Canada.

ANACONDA COLD-HEADING WIRE

take a new look at the way you're making these parts...



Cold-heading and upsetting operations require specific qualities in wire to obtain the optimum in quality and the most favorable unit cost.

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Publication B-33 gives complete details. Write for your copy—or call on our Metallurgical Department to help you with your problems. Anaconda has specialists in this field to help you at any time. See your Anaconda representative, or write: Anaconda American Brass Co., Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

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AIRCRAFT and MISSILES... TRENDS

Changeover no problem . . .

Should the need arise, the US can quickly shift the new facilities it is building for the civilian space program to military use, according to James E Webb, administrator of NASA.

Speaking of NASA programs, Webb said that the "real test" will come next year, when Congress will be asked to support NASA appropriations almost double the $1.7 billion for 1962.

Webb also made these points about the space program in general:

- **Russia will probably send** a multi-man spacecraft in earth orbit and on a circumlunar flight before the US will, but he thinks the US can beat Russia to a manned lunar landing.
- **The vital part of the space program** is maintaining the present enthusiasm of Congress and the public.
- **More than 5000 companies are now engaged** in missile and space work; they have developed more than 3200 space-related products that are now in commercial production.

Largest tantalum-tungsten ingot . . .

Temescal Metallurgical Corp's announcement that it has produced what is believed to be the world's largest tantalum-tungsten ingot marks a big stride forward toward eventual production of larger missile parts.

Giant missiles and spacecraft now on the drawing board call for many components larger than any now being made. Until now, the cost of fabricating such parts had been a major problem.

Measuring almost six feet long and seven inches in diameter, the ingot is composed of 90% tantalum, 10% tungsten, and weighs 1500 pounds. It was made possible by Temescal's (Berkeley, Calif) new electron-beam furnace (AM/MM—Jul 24 '61, p73).

The 90-10 alloy can withstand temperatures from –420 F to +6500 F, and is ductile and easily fabricated.

Space-ship skeletons . . .

Northrop Corp is working on all-purpose skeletons for space ships—structures capable of being fired into space in compact packages, then unfolded to a wide variety of geometric shapes to form satellites, antennas, and re-entry vehicles.

The basic members consist of rings with articulated semicircular or triangular arches. These can be combined for a variety of structures.

A combination of triangular arches with rigid rings of different diameters provides a structure that can fold within itself to form a condensed conical shape. A combination of two rigid rings of the same diameter and circular arches can be made to form spherical shapes of maximum volume and minimum surface area.

Multi-billion-dollar contracts . . .

Aerospace companies are nervously waiting out the awarding of big multi-billion-dollar space contracts by the National Aeronautics and Space Administration in the next few weeks. Proposals have been submitted; final evaluation is now underway.

The contracts are for the production of the 1.5-million-pound-thrust first-stage Saturn S-1 engine; the 6-million-pound-thrust S-1B booster; and the three-man Apollo space capsule. All will be used in the race to beat the Russians in landing a man on the moon.

Virtually every major aerospace company in the country is bidding on at least one of the contracts. NASA says all will be awarded within the next 6 to 8 weeks. All the contracts will run for several years and tally well into the billions.

Division of space programs . . .

Details on the division of space programs between NASA and the Air Force will start coming out soon. Both organizations recently have had top-level reports made on future space programs.

Highly classified right now, the results of these reports are sure to come out in the open early next year when Congress returns, if not sooner.

The Air Force is known to be preparing a list of new space programs that it seeks for Congressional approval and funding. Primarily, the Air Force wants to push manned space flight.

Top service generals are not content to wait on the NASA manned space flight program. They argue that the requirements are different and that NASA's program is too slow to meet military space needs.

If the Air Force can convince Congress of the urgency of getting capabilities in space, it may well touch off a whole round of new space projects the military has on the drawing boards.

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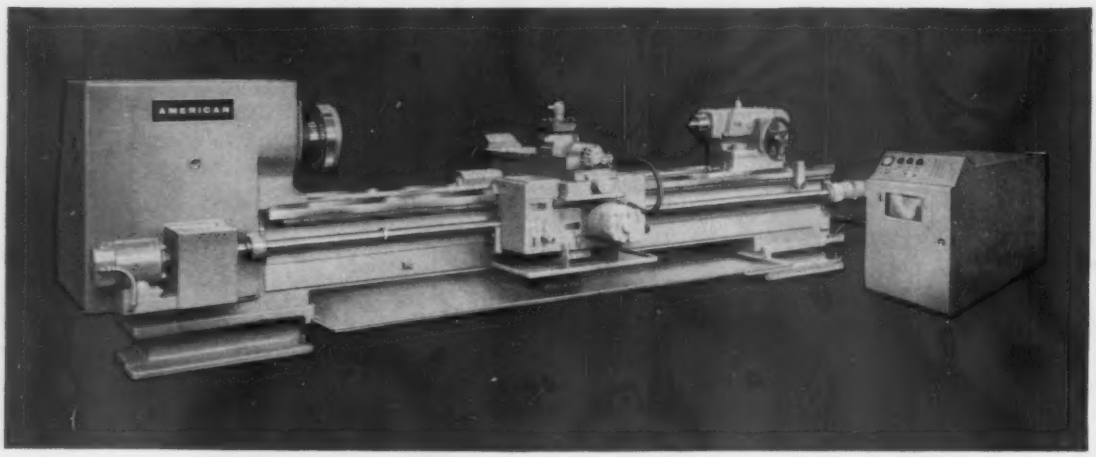

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MACHINE TOOLS...

Big merger broached . . .

Merger of four or five important machine tool builders with non-competing lines has been proposed. The suggestion is believed to have come from a powerful bank whose officials are convinced that such a merger would work out well.

All but one of the companies involved are family controlled. The chances of a merger are said to be low. In fact, at least one of the builders bowed out of the proposed arrangement at the beginning. If the merger were completed, it would create a company with a sales volume that would rank it as No. 2 in the entire industry.

This is not the first time that this group of builders, with one or two variations, has been involved in merger talk.

Prominent machine tool builders are convinced that apart from this particular situation, their industry is headed in the direction of a smaller number of companies, each doing a larger volume of business than the average builder now does.

The necessary outpouring of funds for continuing research and development, not to mention a fast-moving and costly competitive situation, will take its toll of a certain number of builders, observers feel, unless some consolidations are effected.

The trend toward mergers is discernible in Europe as well as here. One of the outstanding examples is the acquisition within the past year or so of the Churchill Machine Tool Co. by BSA Tools Ltd. in England.

1550 N/C machines sold . . .

Some 1550 numerically-controlled machine tools were sold by U.S. builders from introduction up to August 31, 1961, an AM/MM survey shows. Of that number, 1225 had been installed and 225 more were to be in users' hands by the end of the year.

1225 of the N/C machines had point-to-point controls, and 325 were contouring machines. Control manufacturers meanwhile sold 1625 positioning systems and 475 contouring systems, which included all types and degrees of sophistication. For detailed story, turn to page 89.

N/C seminars to be held . . .

11 two-day seminars on numerical control for key executives in manufacturing firms, their engineers, production managers and sales managers are to be conducted jointly by the National Machine Tool Builders' Association and the American Machine Tool Distributors' Association. The first will be at the Biltmore Hotel, Los Angeles, December 4-5.

Seminars, in addition to the initial session in Los Angeles, are scheduled as follows: Jack Tar Hotel, San Francisco, Dec. 7-8; Statler Hilton, St. Louis, Dec. 18-19; Statler Hilton, Cleveland, Jan. 8-9; Netherlands Hilton, Cincinnati, Jan. 11-12; La Salle Hotel, Chicago, Jan. 22-23; Sheraton-Cadillac Hotel, Detroit, Jan. 25-26; Marriott Motor Hotel, Philadelphia, Feb. 5-6; Hotel Kenmore, Boston, Feb. 8-9; Dinkler Plaza, Atlanta, Feb. 19-20; Hotel Adolphus, Dallas, Feb. 22-23.

To find out more about these seminars or to register for them, you should contact local machine tool builders' representatives, or machine tool distributors, or write direct to the NMTBA, 2139 Wisconsin Avenue, Washington 7, D. C.

Machinery sales to rise . . .

Machinery sales will increase modestly in 1962, but nothing approaching the boom proportions of the mid-1950's, H Glenn Bixby, president of Ex-Cell-O Corp, predicted at the recent meeting of the National Industrial Conference Board.

The extent of improvement will depend largely on management of machinery building companies, he believes. Those firms that have developed automated equipment such as N/C machines will continue to be ahead of overseas competitors, but "too many companies are trying to get their customers to buy the same old machines warmed over, instead of aggressively developing new and more productive designs."

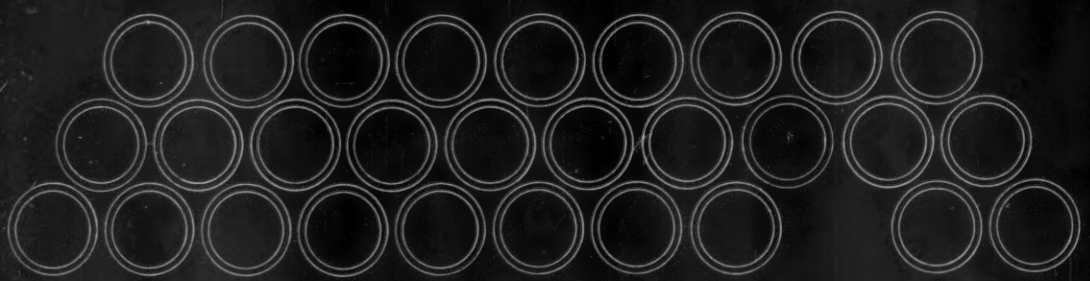
Bixby urged builders to modernize their plants, tighten cost controls, and increase the productivity of their own machines and labor force.

But new products and cost cutting will be of no avail, he pointed out, unless builders do a better job of marketing and sales. "We must plan better and must style and package our machines better," he said, "and must modernize our distribution to keep in step with today's buyers' market.

"If American machinery builders are to maintain their position in foreign trade, they must seek markets in Latin America, Australia, India, and Africa to supplement the Common Market and Japan," according to Bixby.

BF

How do you begin to select the proper steel tube?



How do you begin to select the proper steel tube? Consider it for a moment in terms of your application.

First, there's the choice of tube type. Should it be seamless or welded, hot-finished or cold-drawn? Then, what grade of stainless, alloy or carbon steel will best meet your design, production and end-product requirements?

What about surface finish? Should the tube be furnished as rolled, as drawn, scale-free or polished? How should it be heat treated: annealed, tempered or normalized? Is there a size, shape and tolerance that will come closer to your finished product?

When you consider all the variables, there are literally millions of tube combinations available to you. Only one will give you optimum rate of production at lowest possible unit cost—only one is a *Job-Matched* tube. Possibly we can assist you in specifying it.

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MATERIALS...

Plastics for auto bodies . . .

Polypropylene is a promising material for a large number of automotive applications, according to Dr C W Williamson, project leader, injection molding, Enjay Laboratories. Dr Williamson described this potential at The American Society of Body Engineers' 16th Annual Technical Convention in Detroit. Advantages include flex life, impact strength, stiffness, color, and texture.

Integral hinges in a glove-compartment door have withstood more than three million flexes with no apparent change in strength or dimensions. Reinforcing agents can be incorporated in polypropylene to provide increased rigidity and load-bearing properties at high temperatures.

These fillers also decrease shrinkage in molded parts and reduce the coefficient of thermal expansion. These factors become important in instrument clusters, garnish moldings, complete dashboards, and other large parts which must fit metal parts over a wide range of temperatures.

Urethane foam . . .

Polyester foam systems did not create a great deal of interest in automotive seating for three basic reasons: a "boardy" feel, a low resilience, and continuous loss of height under load. The latter characteristic gives the sensation of continual sinking into the cushion.

Polyether polymers provide foams characterized by a set of properties better suited to seating. However, reactivity of the polyethers with diisocyanates, to produce foaming, was rather slow, and it was necessary to cook them with the diisocyanates to form a prepolymer before conversion into a satisfactory foam. Still the polyether systems provided the soft-to-the-touch feel, high resilience, and comfortable support.

Polyurethanes began to enjoy an unprecedented period of growth. Also, they were less costly than competitive cushioning foams. During this period, reported S M Terry, manager of product development, Reynolds Chemical Products Company, development of the polyether one-shot process appeared—and this break-through started a new era in urethane foam technology.

Practically every urethane system which has been developed is in current use. Polyester one-shot foam is used in fabric laminates and carpet underlays. Polyester prepolymers are used in rigid foams and rather extensively in non-foamed elastomers and industrial finishes. Polyether prepolymer foams are used primarily for molded products in seating, arm rests and crash pads, while polyether one-shot is most attractive for slab and molded cushions for furniture and automotive seating.

The silver situation . . .

Foretold more than a year ago, the silver crisis is materializing. In a matter of months, says the McGraw-Hill publication *Engineering and Mining Journal* (November '61), silver consumers in the US will have to look for new sources of supply. While no one doubts the crisis will be resolved, the method of resolution is widely debated.

"Troika," says E & MJ, is the traditional burden of the industry. Threes occur in all levels of the silver structure. One set consists of silver users, silver producer, and the US Treaury. Three laws influence silver buying and selling: The silver purchase act, the 1946 amendment to the July 31, 1939 silver law affecting purchase of newly mined domestic silver, and the 50% tax on profits from trading in silver. Treasury stocks consist of (1) "sterilized" backing for silver certificates, (2) silver dollars, and (3) "free stocks." Three sources of silver may be opened as the price rises—new production, old coinage, and existing silver now being arbitrarily held off the market.

Despite statistics that prove silver now is more of an industrial metal than a monetary foundation, it still is considered negotiable currency in most of the world.

Industrial use of silver in the US in 1960 was about 100 million fine ounces—or nearly half of the total free-world use. Against a demand, free-world-wide, of 250 to 300 million ounces, mine production is only slightly more than 200 million ounces.

Handy & Harman, largest distributor of industrial and artistic silver, says silver will be available to industry in the future as in the past. Price is the real puzzle in the future of silver—because there are secondary sources at different price levels. When Treasury stocks are gone, the price must go up.

"Free" stocks (silver held by the Treasury, in the Mint, which may be sold to US users) have a delivered price of 91⅝ cents per ounce. Silver futures on the Montreal exchange, where speculation is legal, have been edging over $1 (Canadian) per ounce for delivery in late summer and fall 1962. A price between $1 and $1.10 (US) is likely.

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LOADING: Metal particles packed in between or completely covering the abrasive grains of the belt coating.

GLAZING: Face of belt smooth and glossy—indicates dulling of abrasive grain tips.

STRIPPING: Particles of the grain and bond pulled away exposing bare backing.

WHAT'S AHEAD... in Metalworking

TRENDS

The pickup picks up steam...

At long last, steel orders are beginning to come through from Detroit, with some automakers actually requesting deliveries a week or two earlier than originally scheduled.

Steel people believe that Detroit has run through all the oversupply it accumulated when strikes cut production earlier this year.

And while steelmen don't expect the car makers to lay in more than 60 days' supply, Detroit's steel inventory buildup should lay down a pattern that other industries will follow.

But offsetting the rise in automotive orders are seasonal slackoffs in orders from the construction, roadbuilding and similar industries.

Nevertheless, Detroit's about-face on the inventory question is a good sign.

Makers of aircraft parts report a business pickup of 15 to 20% over this time last year, attributing it to increased defense orders—notably the F4H and NATO F-104 programs. Commercial business is up, too, about 10% over last year.

Mill supply houses say sales of cutting tools and gages have shown a slight pickup in the last two months. They expect it to continue through the rest of the year. The upturn runs from 5 to 7%, enough to bring '61 sales to last year's total.

Plating shops are experiencing a seasonal upturn, mostly in orders from electronics industries. Even so, 1961 is hardly what would be called a good year for platers.

Electrical manufacturers are taking heart from economists' predictions of an upsurge in capital spending. So far, this year has been "good," and they expect a big upswing next year. Said one, "We've got to get the big new equipment moving —can't live forever on replacement business."

Home appliance sales are looking up all along the line. After running the gamut from extreme optimism to black depression, appliance makers are back on the rosy side in their outlook. People are buying appliances again, they say, and they want the big fancy models, whether it's refrigerators, home laundries, ranges or what-have-you.

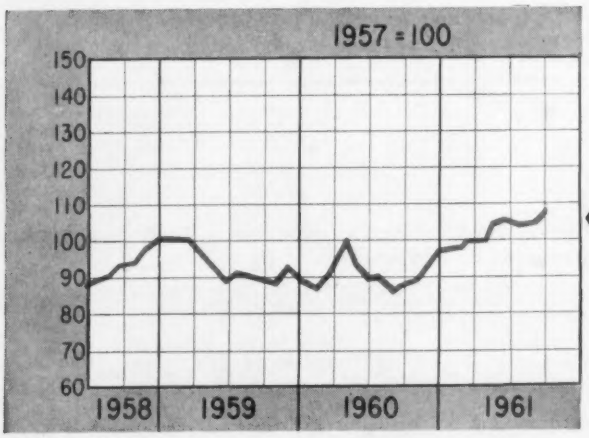
Appliance makers' consensus: "We might just have a real good year. We're moving a lot of merchandise—mostly top of the line."

Especially strong: TV and hi-fi, refrigerators, home laundries, freezers.

And an especially good sign: Appliance makers seem to be out from under the crushing inventory they've been carrying for several years.

Welding shops say business has been spotty in recent weeks, as it has for some time. Even so, fourth quarter activity thus far has been better than for the rest of the year. If there is no sizeable increase in volume soon, business will run slightly under 1960's.

Probably the blackest outlook in all metalworking is that for railroad car builders, who say 1961 will be "the worst year since 1939."



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	OCT Estimated	SEP Preliminary	AUG Revised	SEP Year Ago
Total Index	**105**	**103**	**107**	**107**
Machinery		101	102	106
Electrical Machinery		116	118	112
Autos		96	115	117
Other Transportation		93	90	89
Other Metalworking		109	113	109

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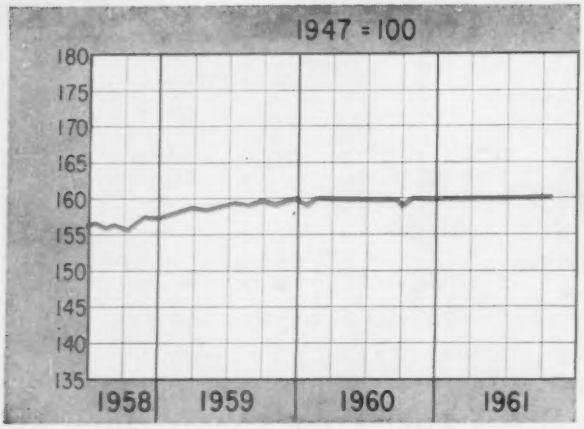
TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

	OCT Estimated	SEP Preliminary	AUG Revised	SEP Year Ago
159.5 Total Index	159.5	159.4	159.4	159.4
Metalworking Machinery	194.5	194.0		193.3
Other Machinery exc. Electrical	174.2	174.2		173.1
Electrical Machinery	156.6	156.7		158.7
Fabricated Metal Products	147.1	147.1		145.2

Unemployment still dogs the economy...

First the target for a reduction of unemployment was mid-summer. Then government officials began to say September, and after that October, but relief never came. Adjusted for the average seasonal decline, the October rate of unemployment was 6.8% of the civilian labor force.

Who are the unemployed? The statistics for September are typical. For the most part, the jobless are the young and the old and women of almost all ages. The rate of unemployment among men aged 35-54 was a respectable 3.7% in September.

Nearly 13% of all teenagers in the labor force were unemployed, however. Women in the 55-64 year age bracket had the lowest incidence of unemployment, with the average rate for all women an even 7%.

Teenage unemployment results from the large influx of young job-seekers into the labor market without corresponding opportunities. This year two million youngsters 14 to 19 years old will enter the work force and a few years hence the annual number will swell to 3 million. The laws of supply and demand apply to the labor market just as well as to any other market, so teenagers toil at low pay, if they find work at all.

The crucial importance of special skill is clearly shown by looking at just the opposite of unemployment — moonlighting. While some moonlighters are factory hands, moonlighting is more important among professional and technical workers whose abilities are in demand. Teachers frequently are offered jobs as consultants or on special projects, for example, while the unskilled search fruitlessly at one personnel office after another.

There are many facets to the unemployment picture and discussions are often at polar extremes. But one popular gage of the seriousness of the problem is the extent of long term (15 weeks or more) joblessness. The number of long-term idle has been edging lower in recent months, but at about ¾ million in September it was double the figure for the same month a year earlier.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949=100)*	161.2	160.3	144.7
Steel ingot operation (thousands of tons)	2,046	2,044	1,468
Electric power output (million Kilowatt hours)	15,250	15,396	14,505
Production of automobiles and trucks	151,758	152,855	138,682
Engineering construction awards (*Eng. News-Record*—thousands)	$75,362	$78,788	$65,634

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949=100)*	112	113	107
Index of durable manufactures production (1947-1949=100)*	105	108	102
Durable goods manufacturers' sales, billions	14.98	15.05	14.41
Machinery manufacturers' sales, billions*	5.00	4.99	4.66
Durable goods manufacturers' new orders, billions	15.74	15.65	14.62
Machinery manufacturers' new orders, billions	5.49	5.07	4.75
New orders for nonelectrical machinery (1950=100)*	193	191	174
New contracts for industrial construction (1950=100)	105	96	179

* Seasonally adjusted

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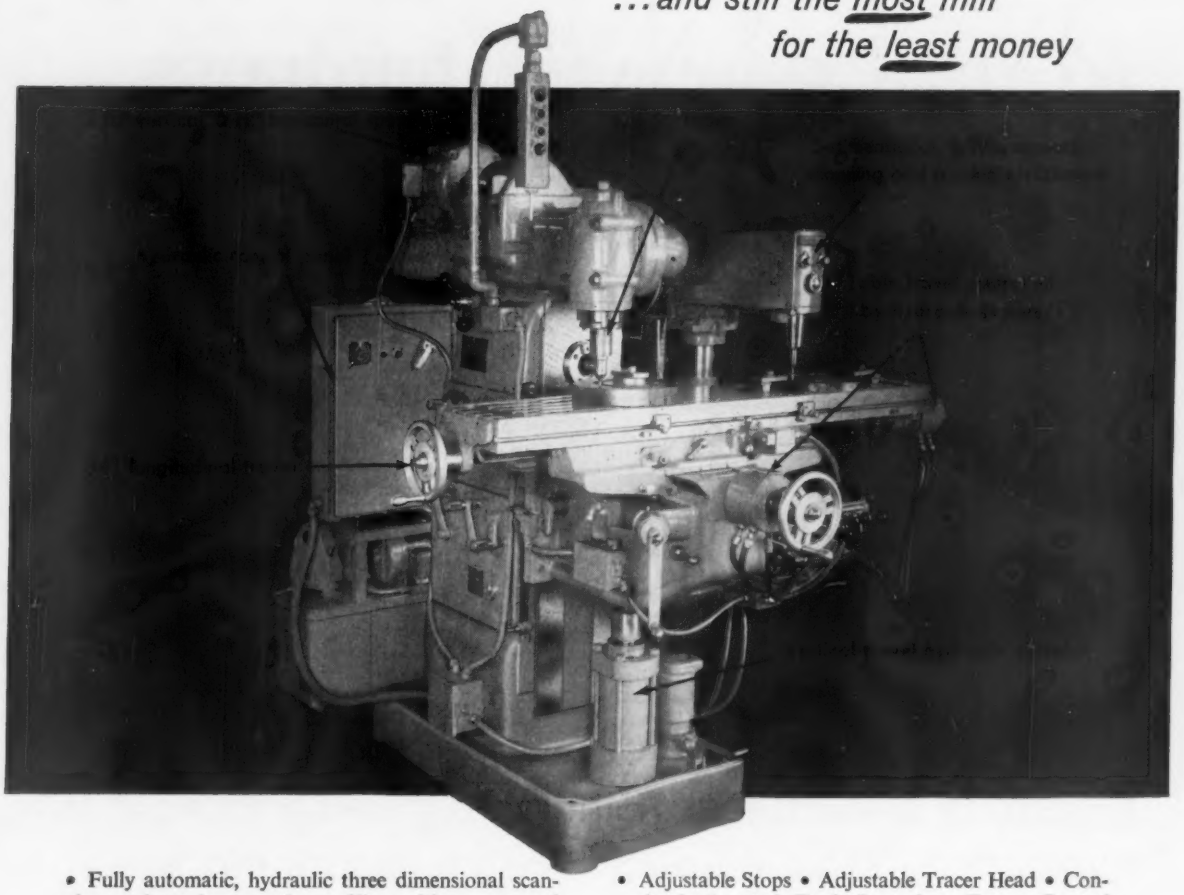

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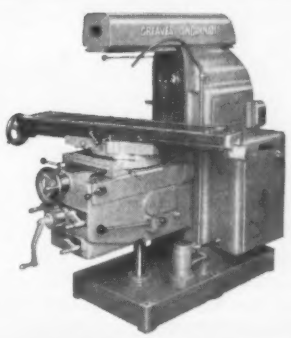

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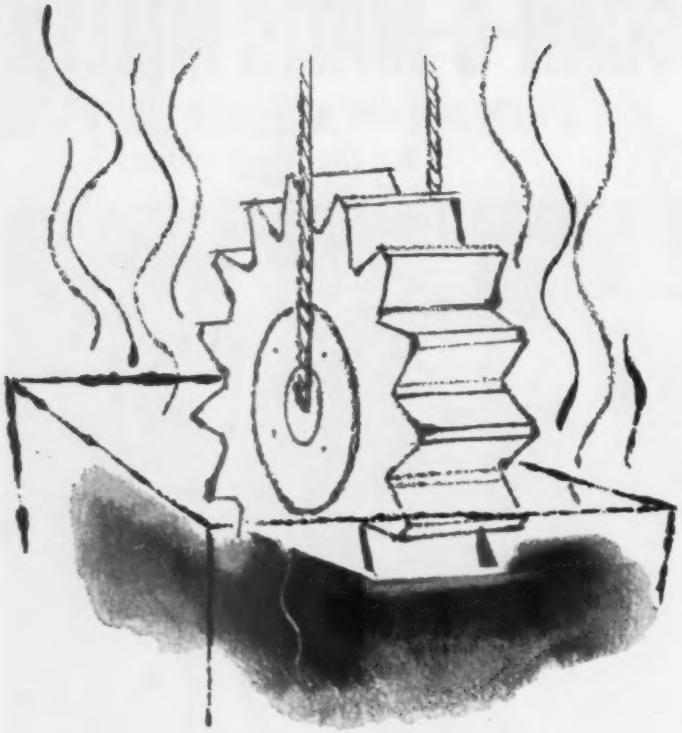

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American Machinist / Metalworking Manufacturing ESTABLISHED 1877

Not By the Seat of Your Pants

Metalworking, for sure, does not need more capacity. It already has too much. So do not count on a splurge of building of new facilities for some time ahead.

This simple, compelling fact gives emphasis to the overriding interest of management in cost reduction. Such interest is inevitable in a period when competition for the buyer's dollar is the deadliest in history.

It gets tiresome . . .
admittedly to keep pounding away on the theme of cost reduction. But if you can find another subject as critical to the success of every metalworking company in this day and age, name it.

Donald Burnham, manufacturing vice president of Westinghouse Electric Corporation, puts it at the center of management's interest. In a recent talk he said that the equipment buying policy of his company is wrapped around it.

His explanation makes sense. You buy new machinery to produce a new or improved product, or to obtain cost reductions, or to secure more production capacity. Cost reduction is by far the most important of these three factors. And he believes that it will continue to be for a long time.

Westinghouse's policy . . .
is to provide increased production capacity by improving the manner in which the work is done rather than by expanding floor area. This policy yields, as a byproduct, added capacity of 3% to 5% a year. What it amounts to is getting out more work in the same amount of space.

In considering the purchase of new production equipment, Westinghouse has one cardinal principle: It will invest in such equipment if an overall saving of 20% or more can be made. Seems simple, doesn't it?

But it is not as simple as that. For the saving is not based merely on an improvement in cutting or processing time. It evaluates total job costs. This means setup time, handling time, inspection time, possibly combining operations, and how to shorten or eliminate any cost elements in performing the operation.

You may not agree with every detail of Westinghouse's equipment buying policy, but it has much to commend it. First of all, it possesses the sound merit of giving management something tangible to go on in deciding whether to invest in new production equipment. It does not leave to chance the spending of vast sums.

Beyond that . . .
it does not make a fetish of building more capacity. It stresses instead the best possible use of existing facilities to cut costs. In doing so, it assesses the whole job to be done and not just a piece of it.

Too few metalworking companies have any tangible equipment buying policy. Most managements seem to be guided by the seat of their pants. That is a pretty poor way to do it, with cost reduction such an overpowering influence in their corporate lives. In these critical and rapidly changing times, they might better take a close look at the Westinghouse program and adapt it to their own needs.

Burnham Finney EDITOR

METRA-TECH...THE IMPORTANT NEW NAME IN CLOSE-TOLERANCE OPTICAL CONTROL

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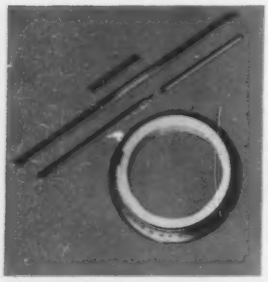
METRA-TECH precision scales and optical tools, some of which are shown here, can work actively for you in tightening your standards, refining your techniques and closing the tolerance gap.



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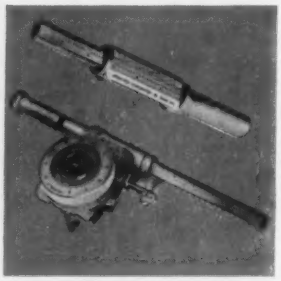

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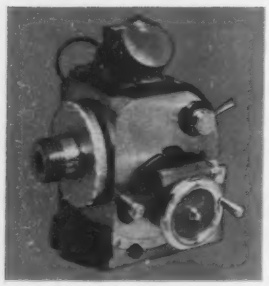

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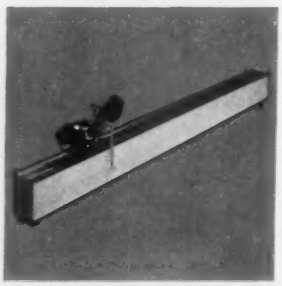

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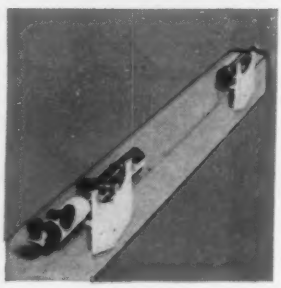

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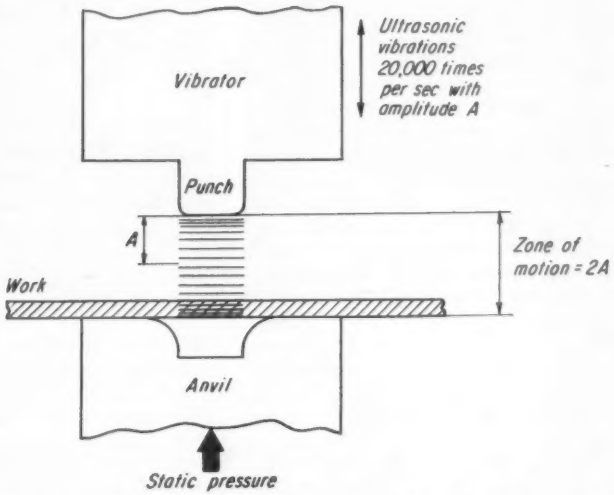
VOL 105, NO 24 **American Machinist** / *Metalworking Manufacturing* NOVEMBER 27, 1961

First report

Forming goes ULTRASONIC

- **A small dimpling press packs the wallop of a piledriver**
- **Friction forces appear negligible**
- **Hot-forming results can be obtained at room temperature**



Static force increases about 30 times when vibrating punch contacts work. When forming is done in this "zone of motion," the metal flows much as it would if it were heated

By James Peacock, assistant editor

First reports are in on the newest addition to the high-energy-rate forming family. (Others: explosive, electro-hydraulic, magnetic forming.) So far, it has only been used experimentally for dimpling titanium and aluminum sheet—both with remarkable success.

Essentially, ultrasonic forming is done by vibrating a press ram as many as 20,000 times per second. The work, resting on a die, is pushed up toward the vibrating punch with constant pressure. When the work is hit by the vibrating ram, the constant pushing force is multiplied as much as 30 times.

Dimpling tests were conducted for Republic Aviation by Dr Lewis Balamuth, R & D vice president of Cavitron Ultrasonics, Long Island City, NY. In the test, A11OAT titanium sheet and 7075T6 aluminum (often used for jet-aircraft wings) were *dimpled at room temperature* with results at least as good as those usually obtained with heated dies.

These metals and another aluminum alloy actually *flowed at room temperature* when they received the tremendous and rapid pressure of ultrasonic forming. This metal flow effect is a striking phenomenon.

Ultrasonics increases plastic flow in the work, just as heat does. But ultrasonics does the job at room temperature. This is because ultrasonic energy enters the work in wave form (regular molecular vibration) rather than as heat energy (random molecular vibration).

Heat is hard to control, and it dissipates energy in all directions. Mechanical-vibration energy, on the other hand, can be directed through the metal and is not wasted.

How it works

The basic theory behind ultrasonic forming is simple. As has been mentioned, the press ram is vibrated up to 20,000 times a second, forcing sheet metal (the work) into a die. This die pushes aganist the work and ram with a constant counter-force. (Future ultrasonic presses might use two opposed rams vibrating 180 degrees out of phase.)

The vibrations are no more than a few thousandths of an inch in amplitude, but because the acceleration is so tremendous, the work is hit by 30 times the constant pushing force. Friction is reduced at the same time because the punch is not in continuous contact with the work. These two effects—high acceleration and greatly reduced friction—combine to give the surprising flow characteristics to the metal.

When titanium A11OAT sheet was test dimpled, it "behaved as if it had a larger elongation and a greater ductility during squeezing." As a result, the titanium sheet was successfully dimpled at room temperature without the aid of heated dies.

Photomicrographs were made by Republic of the inner structure of the ultrasonically formed titanium sheet to compare it with sheet formed conventionally. If anything, the ultrasonically formed sheet had greater uniformity, but Republic did not take enough pictures to warrant a definite conclusion.

In dimpling experiments with 52SO and 7075T6 aluminum sheet up to 0.040 in. thick, metal flow was clearly observed during ultrasonic forming. This flow was sufficient to eliminate the need for heated dies in dimpling the 7075T6.

Economically feasible

Some tests were made with the punch vibrating, some with the anvil vibrating (in the latter instance, the punch was on the bottom and the anvil on top, attached to the vibrating mechanism). Constant pressure required by vibrating the anvil was

less than that needed when vibrating the ram, leading Dr. Balamuth to believe that the frictional work of the anvil is greater than that of the punch during static (non-vibrational) forming.

The results of this first series of dimpling tests indicate that ultrasonic forming is not an expensive process. Cavitron researchers feel that it would be fairly simple to adapt existing dimpling equipment to ultrasonic dimpling. A kit for this, they believe, would sell for less than the cost of converting a conventional dimpler to the die-heating process.

Test setup

For dimpling the titanium and aluminum sheet (admittedly a very narrow segment of metalworking), Cavitron set up a small press in its laboratory—equipped with a 13.5 KC/sec magnetostrictive transducer mounted over an anvil connected to a hydraulic cylinder. The anvil, by means of a compressor used with the cylinder, could exert static pressures ranging from 30 to 1100 psi.

A two-channel Brush recorder was connected to the equipment to give simultaneous read-out of the static squeezing force and the vibratory working stroke of the die during dimpling. The latter pickup (for measuring the working stroke) is a special magnetostrictive device developed by Cavitron.

Dwell time was controlled by a simple relay system, and microswitches automated the total dimpling cycle. For example, during a typical cycle the cylinder would be actuated at some preselected value of the compressor. As the piston rose, a switch would start the vibrator at the beginning of the squeeze. Another would turn off the vibrator when the piston automatically retracted after forming the dimple.

At Cavitron, the aluminum sheet was tested at 14,000 cps with peak-to-peak strokes of 0.0008 in., and a static pressure of 50 psi. The titanium alloy, tested at 10,000 and 14,000 cps, experienced ultrasonic vibrations of about 0.0007 in. when forced into the vibrating punch by a static pressure of 500 psi.

Vibratory energy

For this test—forming 5/32-in. dimples—a pressure of 500 psi on the hydraulic cylinder corresponded to a dead weight force of 6000 lb on the forming areas. Ultrasonic vibrations transform this 6000-lb static force into a dynamic wallop of about 100 tons.

TWO YEARS AGO: A GLEAM IN METALWORKING'S EYE

- **"Possibility that forming can be accomplished with induced ultrasonic waves is being explored."—AM Metalworking Report, November 16, 1959.**
- **Considerable energy can be induced in a part being formed by superimposing the waves on the mechanical forming energy . . . This ultrasonic forming method is a variant of the methods in which energy in the form of high temperature is added to the mechanical forming energy."—AM/MM Metalworking Report, May 2, 1960.**
- **"Micrographs of vibrationally worked specimens also show them to have a more uniform structure than the static specimens. Evidently under vibrational working, there is a lower contact friction between tool and specimen, thus increasing the uniformity of deformation throughout the specimen."—From an article by Y P Sogrishin in Metallovedenia i Termich, (Russian) January, 1959.**

It stands to reason that with so much force caused by ultrasonic vibration, the press ram itself must be of a material that can carry the necessary vibratory power. To find out whether this might present a problem in ram construction, take the formula for a plane wave as a good order-of-magnitude approximation of a material's capacity:

$$\text{Power/unit area} = \frac{1}{2}\,\frac{(\sigma_{max})^2}{\rho c}$$

where σ_{max} is the endurance limit of the material and ρc is the material's specific acoustic impedance (ie, the density, ρ, times speed of sound, c).

Thus, cast iron with an endurance limit a little below 20,000 psi could transmit up to 600 kilowatts per square inch; the carbon steels could readily carry ten times this power. It is easy to see, therefore, that even ordinary metals can carry amounts of energy far beyond normal metal forming requirements.

Packing a punch

This energy-carrying power is strictly a passive virtue, however. In actual metalforming, vibrations must pack enough wallop to deform the workpiece. Where does all this energy come from?

Although the math and physics involved will not be presented here, Dr Balamuth has provided a formula which relates the static force (F_{static}) of a press and the peak force (F_{peak}) produced when the press ram is vibrated with period T:

$$F_{peak} = 1.5\,\frac{T}{t_c}\,F_{static}$$

where t_c is the contact time during each vibration period (when the forming piston and the workpiece are in contact). This contact time is quite small, often 1/20 or less of the period. Thus the static force is multiplied by a factor of 30 or more when the ram is vibrated.

The key to unlocking these fantastic forces lies in penetrating the space through which the ram vibrates. This space (a cylinder as round as the punch and as tall as twice the amplitude) has been named the "zone of motion" by Dr Balamuth and Arthur Kuris, president of Cavitron's Research and Engineering Division.

This zone of motion is hard to penetrate because the peak accelerations produced by high-frequency vibrations are quite high.

For example, if the forming surface of the ram moves through a distance (stroke) of 2A during each period of reciprocation T, then *during each stroke* this surface will achieve a peak acceleration given by:

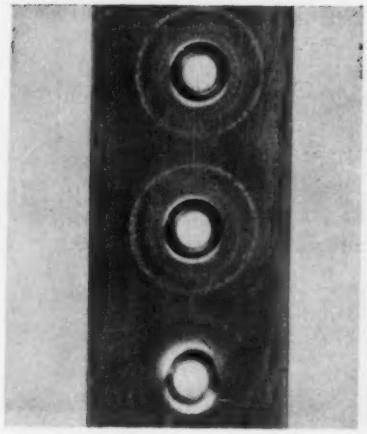
$$\text{Acceleration}_{(PEAK)} = 4\pi^2\frac{A}{T^2} = Kg$$

where K is a constant and g is the acceleration caused by gravity. Using this formula: If the punch is vibrated at 20,000 cycles per second through an amplitude of 0.002 in., the peak acceleration will be on the order of 100,000 g.

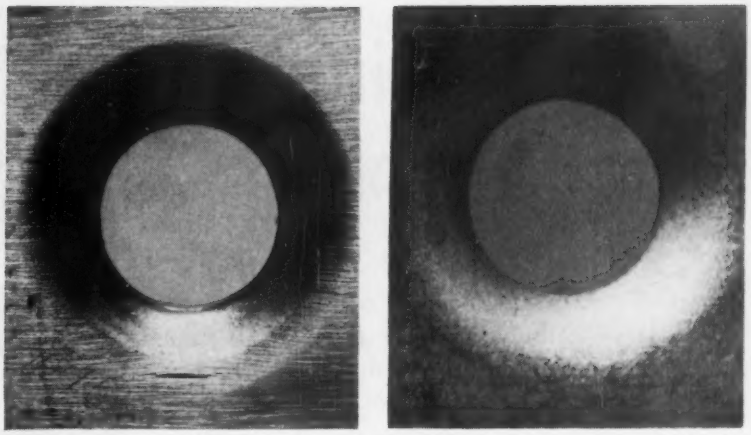
Penetration problem

These tremendous accelerations are unique to ultrasonics. As a matter of fact, to quote Dr Balamuth: "There is no other phenomenon in which a natural body (not an atomic or subatomic particle) can achieve such extraordinarily high mechanical accelerations with a microscopic movement."

One should not, however, apply



Ultrasonic dimpling (top 2 holes) was successful in 52SO aluminum at 50 psi. Dimples were incomplete with same static pressure but no vibration (bottom)



Titanium sheet cracked (left) when dimpled under a static pressure of 500 psi. However, the A11OAT alloy sheet (right) was successfully dimpled when formed under same static pressure, but with punch vibrating at 14,000 cps. The ultrasonic treatment gave surprising metal flow, eliminated need for heated dies in dimpling

this acceleration directly to Newton's second law (F=Ma), because this entire acceleration is not available. The key to obtaining these accelerations lies in penetrating the zone of motion, and the higher the acceleration, the harder this small space is to penetrate.

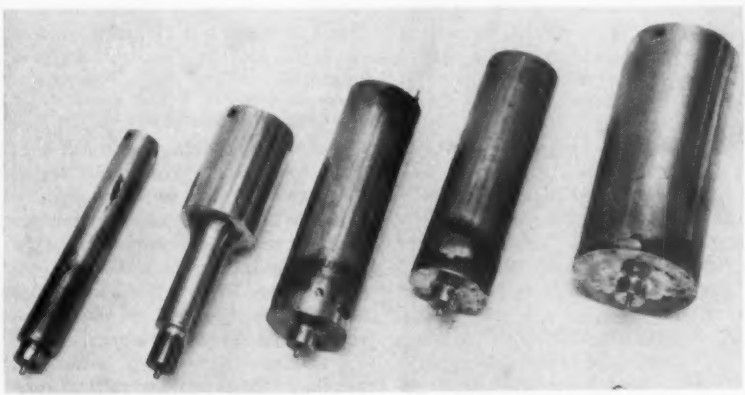
Even though they make the zone of motion relatively impenetrable, these high accelerations make the high peak forces possible. (The contact time becomes quite small, therefore the ratio T/t_c achieves large values.)

Because the zone of motion must be penetrated to take advantage of the potential energy in ultrasonic forming, large static forces are needed to get the workpiece into the zone of motion. For this reason, vibrators must be designed and manufactured so that vibrations cannot be damped out in the presence of large static forces.

Cavitron ran its tests at about 1000 psi (a force of about 12,000 lb) yet the ultrasonic vibrations did not damp out. One reason for this, as shown in the accompanying illustrations, is that Cavitron used vibrators that were large in comparison to the actual forming surface. This mass helps eliminate damping by producing an inertial effect similar to that of a large flywheel in a conventional press.

The tests proved (as was expected) that the highest amplitudes of vibration are attained when the vibrator is nearest the half-wave length of the vibrations. Thus it will be necessary to build vibrators in half-wave lengths for larger presses.

Such larger presses, the Cavitron people believe, could produce some remarkable results, because such tremendous dynamic forces would be available in a vibrating hammer.



Vibrators of different sizes were studied during the dimpling tests. A transducer (vibrator) with considerable mass was chosen to give an inertial effect, much as the large flywheel does in a more conventional press

Reduced friction

There is another advantage inherent in an ultrasonic press (in addition to the large amount of forming force it achieves): In the zone of motion, friction is reduced about as much as static force increases.

This effect, Dr Balamuth believes, is a fundamental advantage of ultrasonic forming (see Soviet quote on this subject). The reason for it is simple: While a workpiece is in the zone of motion, the working surfaces are in contact for only a fraction of each cycle of vibration—a very small fraction, since T/t_c has been shown to be quite large. Thus friction is virtually eliminated as a limiting factor in large forging operations.

To demonstrate: Place a piece of sheet metal between two flat metal surfaces—one of which is the output face of an ultrasonic vibrator—and press them together so tightly that it is impossible to pull the metal strip between the surfaces.

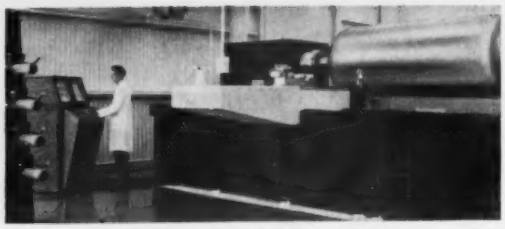
Then turn the vibrator on. Even though a large static force is still pressing the surfaces against the metal strip, it takes only light finger pressure to slide it back and forth. •

Editor's note: *The theories presented here have been applied by Cavitron only in the dimpling application described. Other companies, however, are working with ultrasonic and lower frequencies in the forming field, and information on their work should be released soon.*

Filament winding by the numbers

At North American's Rocketdyne Division

Numerical control has changed a hit-or-miss art into a science—winding fiber glass filaments for missile components. Three N/C machines, two at Rocketdyne and one at Rohr, are now doing the job so precisely and to such sizes that whole new fields of applications are opening up



At Rohr Aircraft's Chula Vista plant

With the advent of the solid-fuel missile, a fairly new manufacturing technique is coming into its own—spinning fine strands of tough fiber glass to a desired shape over collapsible or soluble mandrels.

The fiber glass is then impregnated with plastic, cured in an oven, and the mandrel is removed or dissolved out. The result: a structure with a strength-to-weight ratio far superior to that of steel.

Because of this, it is being used more and more as a high-strength, lightweight substitute for steel in rocket engine cases, closures, pressure vessels, nozzles and other applications where high bursting strength and lightness are essential.

Not only does wound fiber glass add to the range of a missile, or to the capacity of its warhead, it eliminates the need for a compromise between material strength, formability, welding, mechanical joining and other considerations connected with making steel shells.

But up to now, filament winding has been far more of an art than a science. Size limitations and lack of precise control over winding paths have restricted its use where great accuracy is essential.

Enter numerical control

Numerical control has changed all that. Precision is the rule rather than the exception on filament windings turned out on two machines at North American Aviation's Rocketdyne Division, and one at Rohr Aircraft Corp. And the old size limitations have been thrown to the winds. Rohr's machine winds pressure vessels up to 8 feet, 4 inches in diameter, and 18 feet long: one of Rocketdyne's machines will make vessels up to 12 feet in diameter, 40 feet long.

Winding at Rocketdyne

Rocketdye is doing mostly R & D work for the Air Force and Navy. The newest of its two numerically controlled filament winding machines is a 3-axis setup controlled by a point-to-point system developed especially for the job. The operational axes: x the carriage, y the cross-slide; and z spindle rotation.

Standard 1-in.-wide, 8-channel punched tape is programmed to control the three axes for any winding pattern—by feeding an IBM 7090 computer with a mathematical description of the job.

Not only does this cut setup time and tooling for any new part—it eliminates variations in winding patterns from one part to another that might result from cam or gear wear. Thus a part made with the same tape months or even years after the original is an exact duplicate of the first part.

Quality control is more accurate than with conventional winding equipment, and this accuracy is repeatable because tape provides a permanent record of the winding operation for each part.

Since machine tool accuracy is not required in laying up windings for a pressure vessel, Rocketdyne developed and uses point-to-point control instead of the more accurate, and more sophisticated continuous path system.

Axes are moved in increments of 0.001 to 0.003 in. at high speed (as much as 5 fps, contrasted with the more precise but slower continuous path movements of about 1 fps). Positional accuracy of filament laydown on the Rocketdyne machine is within ±0.010 in. from the theoretical path. Greater accuracy can be achieved, however, by running the machine slower.

Conversely, the machine can be run as fast as may be necessary for reasons of economy. Then, the relative speeds of the three axes can be individually controlled to suit specific patterns. (Maximum mandrel speed, for example, is 30 rpm—infinitely variable from zero so that its speed can be changed as the circumference of the vessel changes during build-up). Result: uniformity of pattern, no variations in layup thickness.

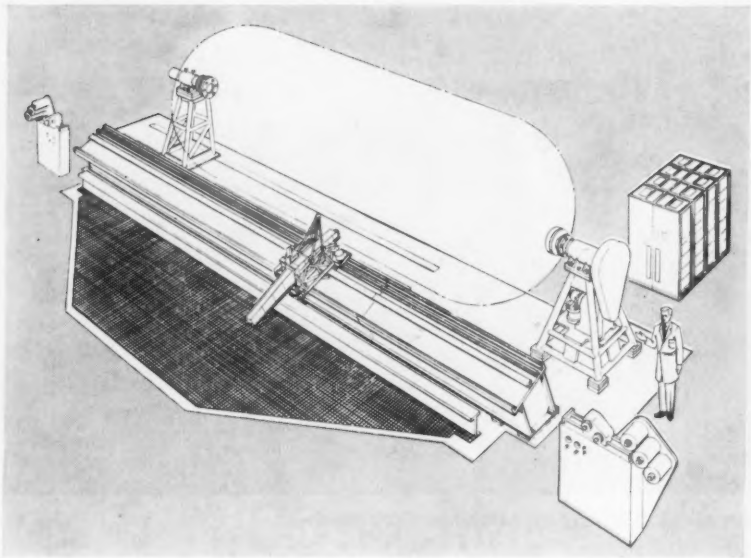
Handles three patterns

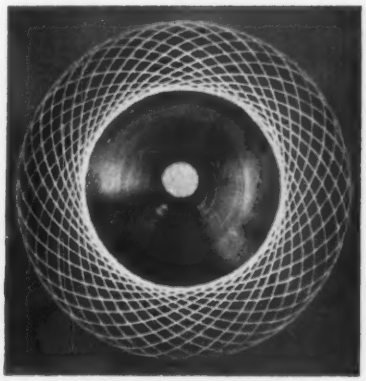
Main advantage of this system is that it is sufficiently flexible to handle three different basic winding patterns: (1) circumferential—fibers are layed down at approximately 90 degrees to the axis of the vessel; (2) helical, and (3) sequential. The latter two patterns are the same, except that sequential filaments are placed side by side, one after another, in sequence. Strength and configuration requirements of a given vessel determine which pattern is used.

Tension on the strands of rovings is held within ± 1 lb/20 filament ends so as to maintain uniform vessel strength.

The fiber glass filament is pre-impregnated with any of the resin systems (silicones, epoxies, phenolics, polyesters or others) depending upon the application.

Rocketdyne's two N/C machines break the size barrier





Rocketdyne N/C filament winder (above) has head and tailstock in one position for vessels under 8 ft diameter, another position for vessels over that. The built-on-an-angle headstock and tailstock swivel 180°. (Upper right) End view of winding pattern. (Lower right) Sequential pattern, one of three basic types, is established by "pay out" head and rotation of the mandrel

Pre-impregnation of the material not only eliminates the need for a "wetting" station at the machine (simplifying the operation and avoiding toxicity problems), but allows use of resins that don't lend themselves to in-process impregnation.

Mandrels are, of course, an important part of Rocketdyne's filament winding operation. Selection of mandrel material and type depends upon such winding considerations as vessel size and the size of port openings. Among the types of mandrels used at Rocketdyne are collapsible mandrels made from a salt-base material that washes out after winding is complete, and (for small vessels) such low-melting-point materials as Cerro-Matrix, which are removed by heating the vessel (already cured at temperatures below the melting point of the mandrel) to the mandrel melting point.

Rohr's setup

Rohr Aircraft's numerically controlled machine, with its Thompson-Ramo-Wooldridge control system, can wind pressure vessels up to 8 feet, 4 inches in diameter and 18 feet long. Actually, the machine is so designed as to allow extension of this length to any reasonable amount.

Motions for winding, controlled by a punched paper type readout and a hydraulic servo system, are powered by hydraulic motors through timing belts to a final gear drive.

Machine motions are controlled in three axes: x, the longitudinal movement of a carriage parallel to the work; y, the transverse movement of a cross-slide on the carriage at right angles to the x axis; and z, the rotary motion of a spindle. This allows winding of any combination of hoop, end and helical patterns.

Computer controlled

The Dage system controlling these movements (and the precise positioning of the filaments) is a solid-state transistorized digital computer specifically designed for this job. Control is governed by a standard 1-inch, 8-channel punched paper tape.

Rohr's Remington Rand Univac Solid State 80 Computer at Chula Vista, Calif, mathematically establishes the critical winding patterns, thus programming the tape.

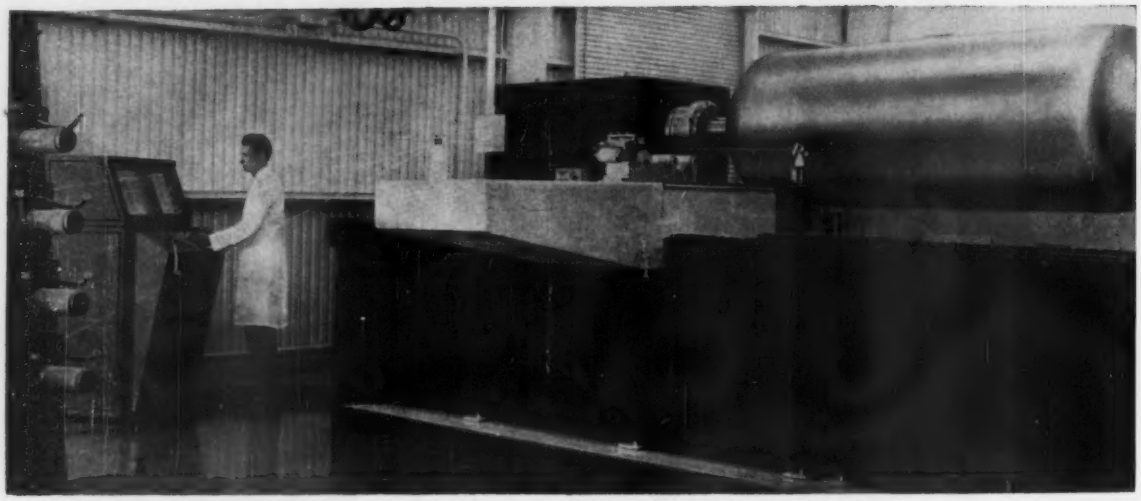
Filament is delivered to the machine from a multiple-spindle creel which holds 12 "rovings" (lengths of loosely wound fiber glass cord) on reels, six on each side. Rohr uses multiple-end rovings consisting of anywhere from six to hundreds of single ends. The machine can pay out and wind a maximum of 360 filament ends.

Because pressure vessel strength depends upon maintaining constant, equal tension in the strands as they are delivered to the mandrel, particular attention is paid to tension throughout the process.

At the creels, for example, spring-loaded friction brakes at each spindle are preset to desired tension. Winding tension is fully adjustable up to 1 lb/filament end.

The rovings come together at the cross-slide on the carriage, where an impregnation system is mounted. Here the filament is wetted with resin by means of a doctor roll. A

Rohr's N/C filament winding setup is accurate, flexible



N/C machine's present vessel size limit of 18 feet can be extended if necessary

following roller squeezes off excess resin, at the same time adding a little tension to the rovings.

After impregnation, the strands enter a "pay off" head on a ram at the end of the cross-slide. At this point, individual rovings are gathered together to form a specific ribbon width that is controlled within ±0.005 in. Close control over ribbon width prevents excessive gaps or overlapping during winding, achieving an intimate side-by-side contact.

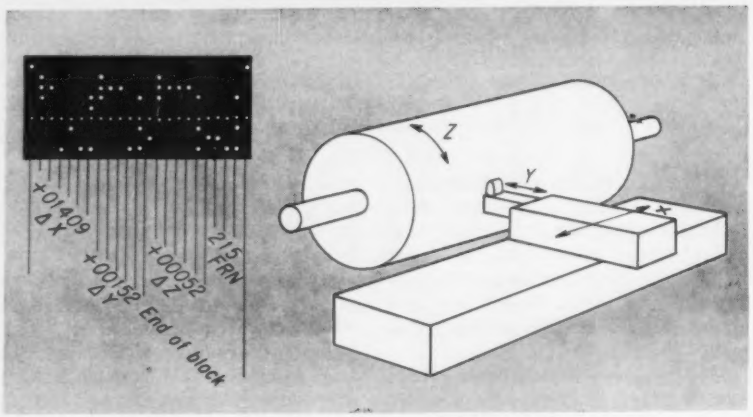
Ribbon delivery control

Delivery of ribbon to the mandrel (in accordance with the programmed winding pattern) is controlled by the relative motions of the x, y and z axes. Speed of these motions can be varied individually to suit varying pattern requirements. Layup of ribbon on the mandrel continues until the required vessel wall thickness is reached.

Takes 10.25 seconds

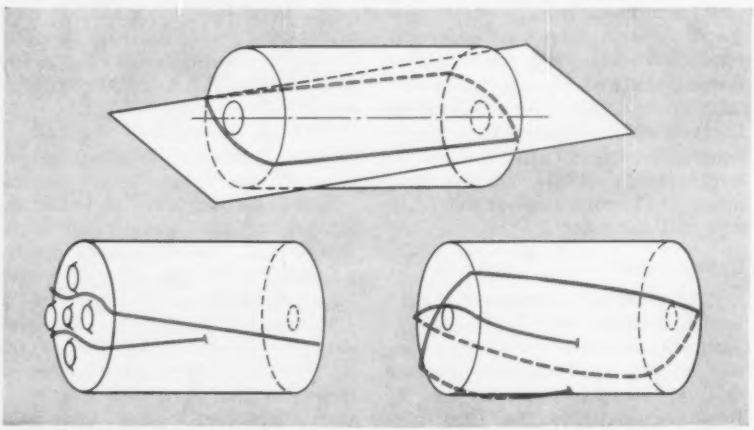
On a current job, Rohr completes the winding span in 10.25 seconds. Time, which varies from job to job, can be reduced by using a faster tape reader in the system.

Insertion of data for setup and experimental use can be manual if desired, and the machine can be stopped at any time during winding for spool change, adjustments, or for eventualities not planned and programmed into the tape. The machine also stops immediately in the event of any electronic or mechanical failure. •

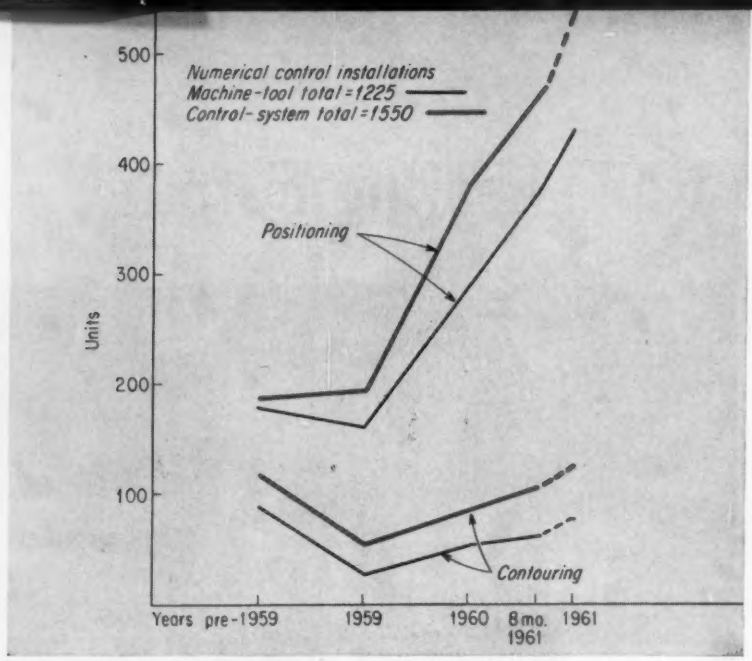


Standard 1-inch, 8-channel punched paper tape (left) controls x, y and z axes of the machine. One block of taped data positions each axis simultaneously

Typical winding patterns



(Top) Plane of longitudinal travel passes the filament above a port opening at one end and below another port at the opposite end. (Lower right) Filament follows a geodesic path around end surfaces. (Lower left) Filament passes around ports



1550 N/C machines have been bought!

Through August 1961, 1550 numerically controlled machine tools were sold. Of this number sold, a total of 1225 were installed and some 225 more will be installed by the year's end. During the same period, sales reported by control-system builders totalled 2100, of which 1550 were installed. About 275 more systems will be installed this year.

Machine tools with positioning controls (point-to-point) had a total sale of 1225 units, while contouring machines totalled 325. Control builders, meanwhile, sold 1625 positioning systems and 475 contouring systems. The latter figure includes all types and degrees of sophistication.

Installations of machine tools with positioning totalled 1000, while 225 contouring machines were installed. Control builders reported installations of 1210 positioning systems and 340 contouring systems.

Figures for machine tools and control systems, of course, *should not be added together.* They duplicate each other in that most of the control systems were sold with the machine tools.

Missing units?

The difference of 550 units between machine-tool sales and control-system sales consists of prototype machines, units bought for unsold machines, retrofit (including some positioning tables), and non-machine-tool metalworking applications. These applications were not studied in detail in this survey.

In addition, control-system sales tend to lead machine-tool sales by some months as machine-tool builders buy the systems prior to completion of the machine.

In just seven years, numerical control has become the most discussed subject in metalworking manufacturing circles. But how much numerically controlled equipment actually has been bought and put to work by the industry? *AM/MM*, to clear up the blizzard of guesses, asked each machine-tool builder known to offer N/C equipment and each N/C system builder how many units he had sold, and how many units he had installed each year, through August 1961. We gathered the data by individual machine types.

Sales through builders

Of some 60 machine-tool builders offering numerically controlled machines, 55 companies gave us the figures. All of the major suppliers are included. Forty-two control-system builders were asked for their sales figures and thirty-seven of them gave us the data. Again, all of the major sources are included.

While new control-system builders are regularly entering the market, we were somewhat surprised to note that the attrition is greater than the influx. A number of the early entries into numerical-control system manufacturing have withdrawn from the commercial market.

Twenty of the 37 control-system builders replying report 100% of their sales are through machine-tool builders. Eight more companies do 80 to 90% of their business through machine-tool builders. Three more companies are on a 50-50 basis. Half of their sales are direct.

More than 90% of the control-system sales to date have been through machine-tool builders. Twelve of the companies offering control systems build their own machine tools, and offer the complete package.

N/C volume?

What percent of 1961 machine-tool sales volume, in units, will be represented by numerical control? Only 39 companies answered this question; some refused because they were too new in the field to know. However, 11 machine-tool builders reported that 75 to 100% of their 1961 business was in N/C. Eight companies reported that 40 to 60% was for N/C and 11 more firms expected 20 to 30% would be for this equipment. Nine companies expect 10% or less from this N/C source.

Thus, for what the figure is worth, an average of 40% of the business of firms selling N/C will result from it.

Turret drills lead the list of specific types of N/C machine tools with a total of 315 sold. The next largest group is jig borers, not including jig-milling machines, with 165.

Multi-operation or "machining center" equipment comes next. Numerically controlled drillpresses add up to about 130 machines. The latter figure does not include conventional machines with positioning tables.

In the continuous-path group, about 100 profile-milling machines represent the largest single type sold. Not all of these sales were reported.

About 15% of the boring, drilling, and milling machines sold with N/C provided contouring, the rest were straight positioning. Altogether, horizontal B, D, & M machines numbered nearly 100.

While the industry-wide acceptance of numerical control is slower than some people anticipated, it is accelerating. Although we may not see 50% of all the machine tools purchased five years from now numerically controlled, a 30% estimate may be too conservative. This represents 10,000 to 12,000 machine tools. •

New furnaces triple bearing output

By William H Smyth,
plant metallurgist
and Robert Lamb, plant manager
Tyson Bearing Company
Division of SKF Industries, Inc
Massillon, Ohio

By adding three new pit furnaces and a radiant-tube rotary-hearth furnace, Tyson Bearing Company has tripled the former roller bearing production capacity of its Massillon, Ohio, plant.

The three new pit furnaces, which have been added to a line of seven older pit furnaces, are capable of carburizing twice the amount of work that the seven older units could handle. Yet the new pit furnaces are about the same size (4½-ft-dia x 5-ft-high heating zone) as the older ones.

The difference is "Power Convection"—an arrangement whereby a heat-resistant-alloy fan at the bottom of each furnace force-circulates the atmosphere-heat-treating gas, distributes convection heating currents evenly, and provides uniform surface contact between the gas and the work. (*AM/MM*—Sep 21 '59, p3.) The gas used for the job illustrated here (and on the cover) is a mixture of carrier gas and natural gas.

All of the new equipment — the three pit furnaces, the atmosphere generators, and the rotary-hearth furnace, which is used to reheat large bearing parts and rolls before they are hardened—was built and installed by Surface Combustion, a division of Midland-Ross Corp, Toledo, Ohio.

Fixture load of Tyson roller-bearing outer races—total weight of 7500 lb—goes into vertical-pit carburizing furnace. Furnace is one in a line of ten

Carburizing technique

Carburizing is actually a surface treatment; it leaves a tough, vibration-resistant core which is softer than the hardened case. For tapered roller bearings, both those with and without cages, the hardened case must average 0.060 to 0.070 in. deep.

The bearings, ranging from 3 to 53 in. in diameter are placed on a three-shelf fixture (see photo, top), then lowered into the furnace and cycled at about 1700 F for as long as is necessary to produce the desired case. Time, temperature, and gas flow are controlled automatically, with each pit handling a maximum load of 7500 lb. Average production per furnace is 800 lb per hour, but this varies with the size and shape of the parts.

Batch heat treating is necessary because of the wide range of bearing sizes produced at the plant. The pit furnaces, which take up little floor space, are efficiently heated by twelve equally spaced vertical radiant tubes that fire and exhaust on the top side of the furnace.

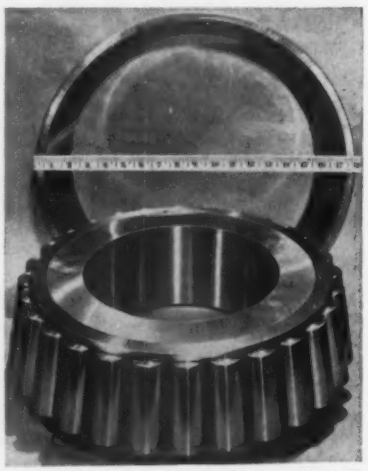
Quenching and hardening

The carburized parts are lifted by crane from the pit furnaces to an oil quench tank across the aisle, then washed and stored before final hardening and tempering in an automatic furnace line.

Those bearing cones and cups that also require press quenching are reheated to 1450-1525 F (depending upon the grade of steel) for hardening in the new rotary-hearth furnace, then die-quenched in semi-automatic presses. Final operations on all bearings include washing and tempering to Rh 59-63C in an automatic line.

The bearing-quality steels used include SAE grades 8620, 7620, 4720, 4320, and 3310. All are checked metallurgically before rolling at the mill. Inspection after heat treating includes checking case depth, case and core hardness, and metallurgical quality.

Soon to be installed is a completely automatic Surface furnace line with an automatic feeding/storage conveyor, wash and rinse unit, continuous-belt hardening furnace, an automatic 8-ram quenching press and secondary cooling tank with conveyor, and a continuous washer and tempering furnace. This will be in addition to existing equipment. •



Unusually large roller bearing (18 in.) used in heavy power equipment is machined and heat treated in same way as smaller roller bearings

NEW NMTBA PRESIDENT
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Cleveland, Ohio

To meet challenge of Common Market

Builders must cut machine tool costs

How to get the American economy out of stagnation and growing again, and ways and means of expanding export business were the chief topics at the annual meeting of the National Machine Tool Builders' Association at the Americana Hotel in Miami Beach, Fla, November 16-17.

The most serious problem facing this country is the high cost level compared with other countries, Everett M Hicks, vice president and general manager of the Machine Tool Division of the Norton Co, said in his presidential address. He expressed the opinion that inflation cannot be halted without government controls unless some way is found to restore competition and curb monopoly in our labor markets by reducing the size of the bargaining units on both sides of the table. If inflation is not stopped, U S currency will have to be devalued to make our costs competitive with other countries.

American industry is being put at a further disadvantage by the rapid development of the Common Market, within the borders of which U S companies will be subject to tariffs that competitors of member nations do not have to pay. Mr Hicks predicted that the rate of industrial growth within the Common Market, now at a phenomenal pace, will not diminish much the next few years.

Even increased mechanization of U S plants is not likely to bring costs down enough, in Mr Hick's opinion, because European competitors are building more modern and more automatic factories than we are. He cited a large German manufacturer who has been buying automatic equipment not because it could be justified strictly on labor savings but because not enough workmen are available otherwise. With foreign companies installing highly automatic factories, Mr Hicks believes that "we have a great deal of modernization to do just to remain even."

Mr Hicks revealed that the ma-

TREASURER (Re-elected)
Lawrence C Gleason
President and general manager
Gleason Works
Rochester, NY

NEW DIRECTOR
Francis L Dabney
Executive vice president
Bullard Co
Bridgeport, Conn

NEW DIRECTOR
Ralph R Baldenhofer
Executive vice president
Thompson Grinder Co
Springfield, Ohio

Cut machine tool costs . . .

chine tool industry is developing a presentation to the Treasury requesting formal determination of much shorter depreciable lives for machine tools. He voiced doubt that simple liberalization of depreciation, however, will be sufficient to accomplish the massive doses of stimulation needed for capital spending. The incentive tax credit, or something similar, he thinks, "has a great advantage in that it not only does not change reported earnings before taxes, but has the effect of increasing profits after taxes because it diminishes the tax itself."

England's "investment allowance" is a simple device having the same effect as a tax credit, Mr Hicks suggested. Using it, a machine purchaser could deduct on his tax return in the year of acquisition an additional percentage of the purchase price (say 30%), and this extra depreciation is not subtracted from the total price paid for the machine for depreciation purposes.

Japan's current industrial boom, biggest in history, has resulted in production of goods and services being three times greater than before World War II, Charles B DeVlieg, board chairman of DeVlieg Machine Co, told members and guests. He first visited Japan in 1952 as a member of a U S mission and has been there seven times since then, most recently with a Commerce Department trade mission.

50% write-off in first year

A government policy of allowing 50% depreciation the first year, with the remainder spread out over 14 years, is partially responsible for the Japanese machine tool boom, DeVlieg believes. This policy has had the same stimulating effect as Denmark's, which permits 30% depreciation the first year and 30% on the balance each year thereafter.

The Japanese need advanced types of machine tools from this country, DeVlieg said. They have standard machines in abundance and today have a formidable machine tool industry. But the industry has many limitations preventing it from matching U S advanced machines. Skilled and semi-skilled labor in Japan, incidentally, is getting scarce.

Germany is a good market for U S firms with energetic sales programs, because German companies, facing labor shortages and rising costs, will be seeking new cost-cutting methods and equipment in the years immediately ahead, William E Rutz, industrial consultant, Giddings & Lewis Machine Tool Co, stated.

Almost all of Germany's new plant and equipment is of conventional type and design, built up prior to numerical control, Rutz said. It is difficult for many Germany companies to believe that their techniques are obsolete and that the use of numerical control requires a new way of thinking. Thus firms in the United States with N/C machines have a 3-to-5 year head start. •

Corrections and additions to N/C selector guide

Typographical errors have been found in the N/C Selector Guide (*AM/MM*—Oct 30 '61) on the Brown & Sharpe Model B Turret Drill and the Ex-Cell-O Corp Numera-Trol Model 758. Details are listed at left below for posting in your copy. Also included are two entries received too late.

Brown & Sharpe Mfg Co—Model B Turret Drill—Normal operating accuracy, which was incorrectly listed as ±0.015 in., should be ±0.0015 in. The entry for "Typical parts produced" should read: "Small pieces with holes from 0.040 to 0.060 in. with up to 1-in. —8 tapped holes

Ex-Cell-O Corp — Numera-Trol Model 758—Normal operating accuracy, which was incorrectly listed in the tabulation as ±0.002 (center); ±0.005 (dia) should be listed as ±0.0002 in. (center); ±0.0005 in. (dia)

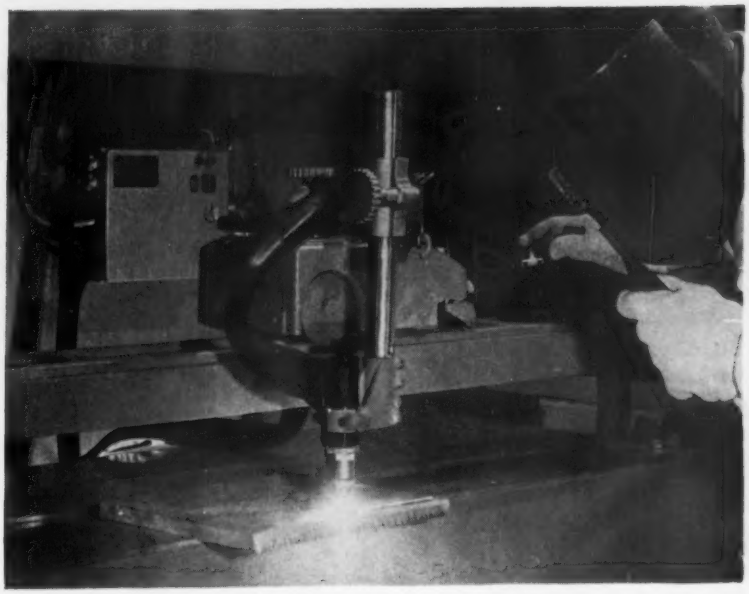
Company name	Seneca Falls Machine Co
Address	Seneca Falls New York
Tradename or model number	Model 400
Type or function	N/C tracer lathe
Capacity	20-in. swing; up to 110 in.
Longest axis of motion	Up to 110 in.
Spindle horsepower	40 hp
Number of controlled spindles	One
Minimum decimal input	0.001 in.
Smallest motion increment	0.0003 to 0.0004 in.
Normal operating accuracy	±0.002 in.
Repeatability	±0.001 in.
Controlled motions	Two, cross slide and carriage
Degree of control	Contouring
Type of data-input media	Decimal dial setting
Feedback?	Yes
Type of drive	Mech amplifier, dc motor
Speed range	—
Feed range	0-60 ipm, sld; 0-300 ipm, car
Control system	Seneca Falls
Manual operation?	Yes, dec dial & pushbutton
Auxiliary functions	Tool index, start back attachments, spindle speed
Automatic tool changer	No
Normal programming procedure	Manual
Are sub-routines available?	No
Fail-safe devices?	Yes
Safe ambient temperature	120 F
Special tool preparation	Yes
Zero offset range	±0.080 in.
Zero shifting method	Dial
Service provisions	By factory representatives
Training offered	Yes, at SF or customer's plant
Normal time to learn	3 to 5 days
Average installed cost	$44,000
Typical job-lot size	1 to 25
Productivity over conventional	6 to 1
Designed for N/C?	Adapted
Typical parts produced	Shafts, gears, carriers, axles, spindles, and other automotive parts
Additional information	Dial-programmed tapers bring part to approximate size. Then control shifts lathe to templet control for rough cut with offset and then final finish pass with no programmed offset

Company name	Seneca Falls Machine Co
Address	Seneca Falls New York
Tradename or model number	Seneca Falls
Control function	Sequence, position
Control type	Analog, absol, closed loop
Number of controlled axes	2, simultaneously
Input media	Decimal dials
Manual input possible?	Yes, decimal dials
Programming method	Manual
Information coding method	Decimal dial input
Basic measuring system	Leadscrew
Smallest input increment	0.050 in.
Normal system resolution	±0.0003 to 0.0004 in.
Recommended accuracy range	±0.001 in. (posit) ±0.0005 in.
Repeatability	
Maximum cumulative error	None
Zero offset range	±0.080 in.
Zero shifting method	Electrical bias
Types of drives controllable	All types
Maximum drive power	No limit
Number of drives controlled	Two
Longest practical motion	110 in.
Maximum positioning feed rate	300 ipm
Time to move all axes 10 in.	6 sec
Standard auxiliary functions	All std functions plus tracer carriage shift, backing
Will it control tool changer?	No (will index tool block)
Type of visual display	Input data
Type of data interpolation	None
Basic circuit construction	Elec tubes and transistors
Maintenance considerations	Modular construction
Self-checking capability	None
Maintenance service provided?	Yes, by Seneca Falls
How many locations?	Seneca Falls or user's plant
Training offered?	No formal, given as required
Average installed cost	$10,000
Most suitable applications	SF's Model 400 tracer lathe, plus any basic positioning applications
Additional information	Contouring is done by programmed tapers to approximate size followed by shift of machine control to templet control, with and without zero offset

PLASMA CUTTING TORCHES

What they CAN do

What they CAN'T do



Plasmarc torch takes a straight mechanized cut in 1-inch aluminum. Control unit on wall turns torch off at end of cut, but operator also has an emergency stop button. Basic torch and control unit shown here cuts up to 1½-inch aluminum, or 1-inch stainless steel

The plasma cutting torch can already do many jobs that the oxygen torch can't, and it is improving all the time in quality of cut and capacity. Here is a rundown on what plasma cutting can do today, and the equipment to put it to work

By Richard E Berg, associate editor

Plasma torches have been cutting aluminum, stainless steel, and other metals in industrial shops for over six years. During that time, however, improvements in equipment and technique have advanced the process to the point where it can now cut much thicker plate and can do a much better job than when it was originally introduced by Linde Co, Division of Union Carbide Corp.

Briefly, today's process covers the range from ¼- to 5-in.-thick aluminum and from ¼- to 4-in.-thick stainless. Further, it can produce dross-free cuts in stainless up to 2 in. thick, which means there's no chipping or grinding to be done after the cutting operation.

It can cut many other metals, too. Magnesium reacts about the same as aluminum, and there is a whole group of materials that falls in the same category as stainless steel: nickel, Monel, Inconel, cast iron, high alloy steel, and clad steel. Copper needs the same power settings as stainless, but, like aluminum, it has no dross at the bottom of the cut.

For cutting carbon steel, the plasma torch has several advantages over the oxygen torch. With its extremely hot flame, it can cut about twice as fast, and it leaves a narrower heat-affected zone, only about 0.040 in. thick. However, it is presently limited to about 4-in.-thick steel, and it does not produce as square a cut edge as the oxy-fuel-gas process does.

Special advantages

When cutting other metals, though, the plasma torch has a special advantage. The oxy-fuel-gas torch needs iron, and it can cut other metals only when iron powder is introduced into the oxygen stream at a carefully controlled rate. The plasma torch needs no such assistance.

When this term plasma came into metalworking a few years ago (*AM/MM*—Nov 3 '58, p87), it caught everybody a little by surprise. Then it turned out that there's really no need to be mystified by it.

Technically, a plasma is a gas that has been heated to such a high temperature that it turns into positively charged ions, highly excited neutral atoms, and negatively charged electrons. We can also say that plasma is the fourth state of matter, the other three being gas, liquid, and solid.

And this is where we find the real significance of plasma for cutting metals. There's a factor of latent heat involved when matter passes from any one state to the next.

Just as we have to supply latent heat to turn water at 212 F into steam at 212 F, so the plasma torch has to supply energy to a gas to turn it into a plasma. Then the plasma carries this tremendous load of heat from the orifice of the torch and slams into the workpiece, melting the metal in its path and blowing it through the kerf.

Two kinds of heat

Since the objective is to throw the maximum heat at the work, plasma cutting torches operate with a transferred arc, so the work is subjected to both arc heat and plasma heat.

In the non-transferred-arc torch, the arc is established between the electrode and the nozzle of the torch, and only the hot plasma leaves the torch. This arrangement has less heating effect on the workpiece, so

Typical Plasmarc cutting conditions [1]

Metal	Thickness (in.)	Speed (ipm)	Amps	Volts	Gas Flow (cfh)
Stainless Steel	¼	100	400	60	100
	½	60	380	107	200
	¾	35	380	110	200
	1 [2]	18	400	110	200
	1	30	600	110	200
	1½	20	620	115	200
	2	20	700	120	200
	2½	15	700	125	200
	3	12	700	130	200
	3½	9	700	140	200
	4	5	700	160	300

Metal	Thickness (in.)	Speed (ipm)	Amps	Volts	Gas Flow (cfh)
Aluminum [3]	¼	300	400	70	60
	½	150	400	65	60
	¾	75	350	70	70
	1	50	400	72	70
	1½	35	400	80	70
	1½	60	700	83	100
	2	35	700	87	100
	2½	25	700	92	100
	3	20	700	130	200
	3½	15	700	145	200
	4	13	700	155	300
	4½	10	700	160	300
	5	8	700	170	300

1. All conditions based on mechanized cutting with Linde H-35 mixture (65% argon and 35% hydrogen).

2. Not a dross-free cut; all other stainless cuts up through 2 in. thick are dross free.

3. Magnesium cutting conditions are close to those shown for aluminum, but higher cutting speeds can be attained.

4. Heavy-duty conversion kit required for all cuts in colored areas of the table.

it's a valuable tool for applying coatings, but not for cutting.

The transferred-arc torch operates with the workpiece in the electrical circuit, so the arc travels from a tungsten electrode to the work. And of course, there's a flow of inert gas through the torch. In these respects, it is similar to the Tig-welding torch (tungsten, inert-gas).

In fact, Linde Co originally called the process Heliarc cutting because of its close relationship to the company's Heliarc (Tig) welding process. However, now that the welding torch can do a limited amount of cutting on its own account—up to ½-in.-thick aluminum and stainless—the company has decided to distinguish between the two processes. Therefore, plasma-arc cutting has been given the trade name of Plasmarc cutting.

Major differences between the two processes are in power level, rate of gas flow, and design of the nozzle. The nozzle of the plasma torch has a relatively small opening, to constrict the arc, and the tip of the electrode is located within the nozzle instead of protruding as it does on the welding torch.

Thus, the inert gas must flow *through* the arc where it is heated to the plasma temperature range. Then, instead of expanding as it would like to, it is forced through the nozzle and emerges in the form of an extremely high-velocity, high-temperature jet.

The equipment lineup for Plasmarc cutting consists of the Plasmarc kit itself—torch, control unit, and appropriate cables and hose—plus the electrical accessories and expendable supplies purchased separately. These include a d-c power source (usually arc-welding machines), a high-frequency unit for starting the pilot arc, and supplies of argon-hydrogen gas mixture and cooling water.

Two steps

In terms of the torch and control equipment, there are two successive steps in Plasmarc cutting: 1) a basic unit for lighter cuts and 2) a conversion kit that combines with the basic unit to cut the full range of thicknesses.

The basic torch and control can cut aluminum and magnesium up to 1½ in. thick and stainless and other metals up to 1 in. thick. For these thicknesses, the power source, or combination of sources, must supply up to 400 amps at 80 v under load.

To cut 1¾- to 5-in.-thick aluminum and 1¼- to 4-in.-thick stainless, the basic unit must be supplemented with the conversion kit for heavy-duty cutting. Here, the power source has to supply a maximum of 700 amps at 170 v.

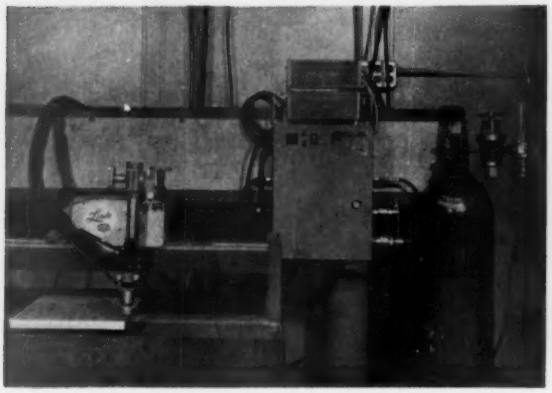
The main purpose of the heavy-duty conversion kit is to equip the basic unit for the higher currents (400 to 700 amps) that are required for heavier cuts. The elements of the kit are fairly simple and include a larger tungsten electrode, a larger orifice, and an extra resistor for the pilot-arc circuit. To provide a greater flow of cooling water, a water pump is also added.

High gas-flow rates (over 100 cfh) are an important requirement of heavy-duty Plasmarc cutting. Introduced in the past year, the high-gas-flow technique has greatly extended the thickness range.

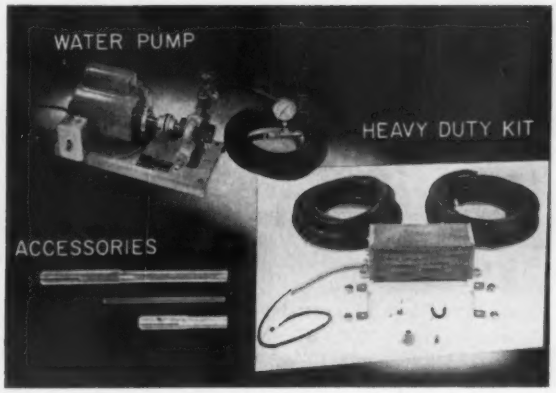
Further, in cutting stainless up to 2 in. thick, it has eliminated the dross that formerly had to be removed by chipping and/or grinding before further processing. Cuts in stainless thicker than 2 in. do have dross, but there's less of it, even at these thicknesses, than there used to be in thinner cuts made without high gas flow.

Along with the torch and control unit, there has to be a power supply, of course. Plasmarc cutting operates with straight polarity (electrode negative) and needs a d-c power source with a drooping volt-

Plasmarc cutting equipment



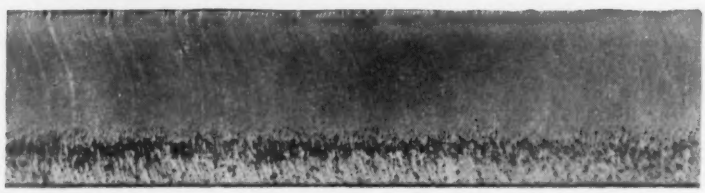
Basic torch unit (left) when combined with heavy duty kit (right) will cut aluminum up to 5 inches thick, and stainless up to 4 inches (dross-free up to 2 inches). Addition of the



heavy-duty cutting parts and accessories shown above equips the basic Plasmarc unit for operation at currents that vary between 400 and 700 amps

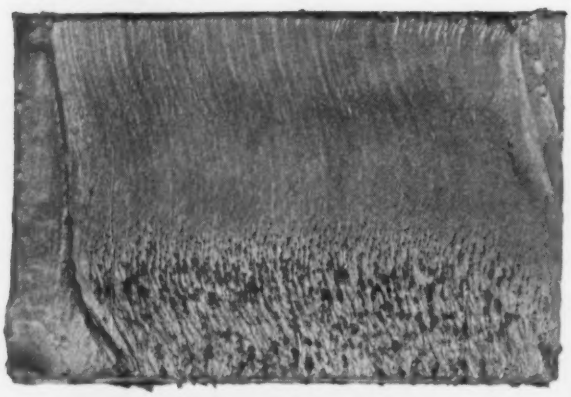
Typical cuts made with plasma torches

2-inch stainless

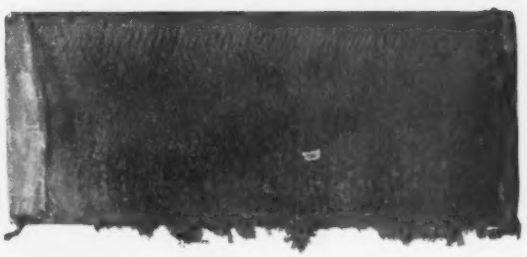


4-inch stainless

4 ½-inch aluminum



2 ½-inch stainless



1-inch stainless

2-inch aluminum

ampere curve. Welding power sources (either motor generators or rectifiers) fit this description very nicely, but very few of them can meet the complete voltage requirements, even for cutting relatively thin materials.

Machines in series

Therefore, the normal procedure is to connect two or more welding machines in series. It's only a question of finding the combination that can produce enough current and voltage (voltage under load) for the expected range of cutting.

However, there is a good deal of latitude in the power level for any particular cut. The operating conditions shown in the abridged table on p94 are not absolutes; most of them, in fact, represent the highest possible cutting speeds consistent with good quality.

If the power available in a given situation is somewhat below that shown in the table, chances are the process can still make a good cut, but at a lower speed. Notice, for example, the two sets of conditions for cutting 1½-in. aluminum.

The two sets are intended to show that the cut can be made with either the basic unit or the heavy-duty setup, but they also indicate the wide latitude of power for one cut.

The same is true of the two sets of conditions for 1-in. stainless. However, as stated in footnote 2, the lower power level here does not make a dross-free cut. Except for this one instance, all the recommended settings for stainless (up to 2 in.) should produce dross-free cuts, but any reduction in power or gas flow is apt to leave dross at the bottom of the cut.

The first step in making a Plasmarc cut is to adjust the power supply and the gas flow to the apppropriate settings. Then, when the operator pushes the start button on the remote-control box (or pulls the trigger on the manual torch), the control unit performs all on-off and sequencing functions. Of course, the cooling water must also be turned on, or the water-flow interlock will block the starting circuit.

The recommended gas mixture for mechanized Plasmarc cutting is 65% argon and 35% hydrogen. For manual cutting it is 80% argon, 20% hydrogen.

Manual cutting is usually done on large workpieces or in remote locations, but for repetitive operations or shape cutting, mechanized operation is the rule. The torch can be guided by any kind of tracing equipment and will hold tolerances of ±1/16 in. Minimum radius of contour depends on the performance of the shape-cutting machine.

To make a mechanized cut, the operator locates the center of the torch about ¼ in. above the edge of the plate to be cut and pushes the start button. The high-frequency generator then sends current to establish the pilot arc between the electrode and the nozzle; gas starts to flow; and current from the power supply is turned on.

The pilot arc sets up an ionized path for the cutting arc. Then, as soon as the cutting arc is established, the high-frequency current is cut off, and the carriage starts to move.

When the cut is completed, the arc goes out because it has no ground. At this point the control stops the carriage, opens the main contactor, and shuts off the gas flow.

Routine safety precautions

Safety precautions are approximately the same as for arc welding: a suitable eyeshield to protect the operator from the glare of the torch and protective clothing to keep him from being burned by spatter. Ventilation should also be on a par with that for arc welding. For manual heavy-duty cutting, an extra metal shield should be attached to the torch handle to protect the operator's hands. •

Custom Plasmarc cutting "in the field"

Said to be the first steel service center in the country to do on-the-spot, tailored-to-customer-needs cutting of stainless by the the Plasmarc process, Morrison Steel Co of New Brunswick, NJ, is cutting stainless in either straight or circular configurations up to 4 in. thick.

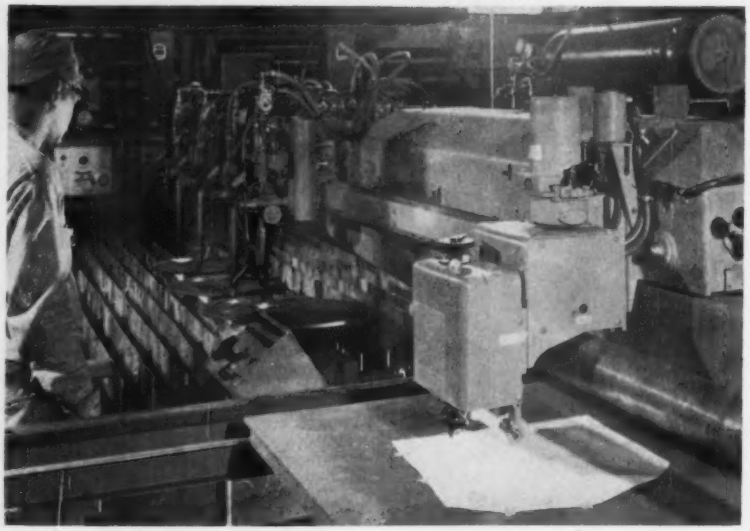
Intricate on-the-spot cuts

Not only does Morrison now cut configurations too intricate and too complex to be done by abrasive sawing or even powder cutting, the arc-cut plate can be welded immediately without machining or annealing of the cut edges.

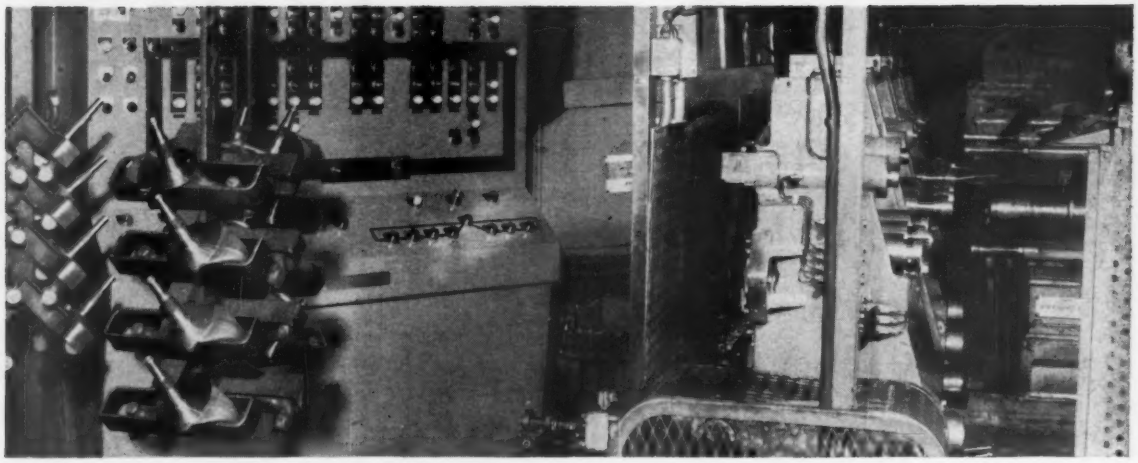
Advantages

The advantages of Plasmarc cutting to steel service centers, Morrison officials say, are several:

- Stainless parts can be used directly after Plasmarc cutting without pre-use preparation.
- Customers can order parts directly, thereby saving themselves expensive fabrication steps.



- Service centers can expand their inventories of plate sizes to include sizes that could not be handled by other cutting methods.
- Plasmarc cutting prevents carbide precipitation, does not distort or discolor the metal, and does not change the machinability or magnetic permeability in areas immediately adjacent to the cut. •



Getting the bugs out of coolant

By Charles Emerson, Detroit Editor

Just as deadly to cutting fluids as some germs are to people, anaerobic bacteria (bacteria normally killed by contact with air) can separate the emulsion into water and oil—causing a machine to operate with a coolant that is practically nothing but water.

What happens is this: hydraulic fluid ("tramp oil") seeps past seals and along slideways of machine tools, doing no harm to the machine or work. But when it settles in a coolant system tank, or in other spots with low turbulence, the tramp oil floats on top of the coolant emulsion, sealing off the air and allowing anaerobic bacteria (which breed where air is not present) to multiply.

Lowers oil content

The bacteria separate the coolant emulsion into water and oil, allowing the system to circulate a coolant that steadily grows lower in oil content, higher in water content. Result is coolant that is practically water, with no lubricating qualities.

Inevitably, cutting action is poorer, tool wear is higher, rancidity is widespread, and so is gumming up. This means a complete system cleanout every four months or so, as opposed to a cheap, fast maintenance job.

Faced with this problem in the operation of transfer machines for making forged-steel steering knuckles, Pontiac solved it by the old "It takes money to make money" principle, paying 40% more for a heavy-duty emulsion coolant to replace a medium-duty coolant.

The more-expensive, tougher oil not only has a positive effect on cutting tool action, it holds down bacteria growth, and cuts down on oil loss caused by rancidity and hard water.

The new soluble cutting fluid, made by Kerns-United and designated as 42LB in the Pontiac plant, has a number of advantages that offset the 40% cost premium over medium-duty fluid:

First, it contains bactericides which, while they don't hold down bacteria growth completely, do retard it considerably. Still remaining in the system are aerobic bacteria, which propagate in the presence of air, but even as little as 0.25% of the bactericide in the cutting fluid can normally control such aerobic bacteria.

The new cutting fluid contains higher percentages of chlorine and sulphur, and a fat content close to 50%. Consequently, it can be mixed in a ratio of 4% to 96% water, as opposed to the usual 10% concentrate and 90% water. Lubricity with the lower concentration is just as high, or higher, than that with the usual concentration, but the actual quantity of oil required for the new cutting fluid is much less.

Fluid that holds up

The new fluid also has much higher resistance to split-out—meaning that the emulsion does not break down as rapidly. This, plus higher resistance to bacteria, adds up to much longer periods between cleanouts. By present indications, cleanout once a year is possible, which dovetails so neatly with the auto industry's annual model changes and retooling programs that there will likely be no productive time lost in cleanout.

Emulsifying tramp oil

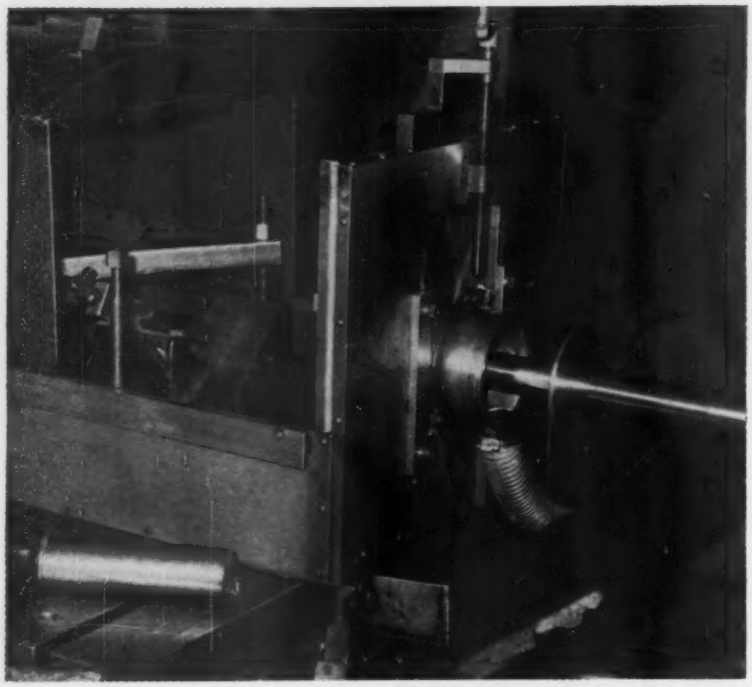
When tramp (hydraulic) oil does seep into the system, it becomes emulsified by the superior emulsification built into the new heavy-duty soluble oil. As this emulsification progresses, the concentration of the solution rises above the original 4%. Such an increase can be tolerated up to 8%, at which point the concentration is adjusted by throwing out about half the solution and diluting with water to required operating level. Further adjustment is made if necessary by adding new concentrate.

Hard water troubles

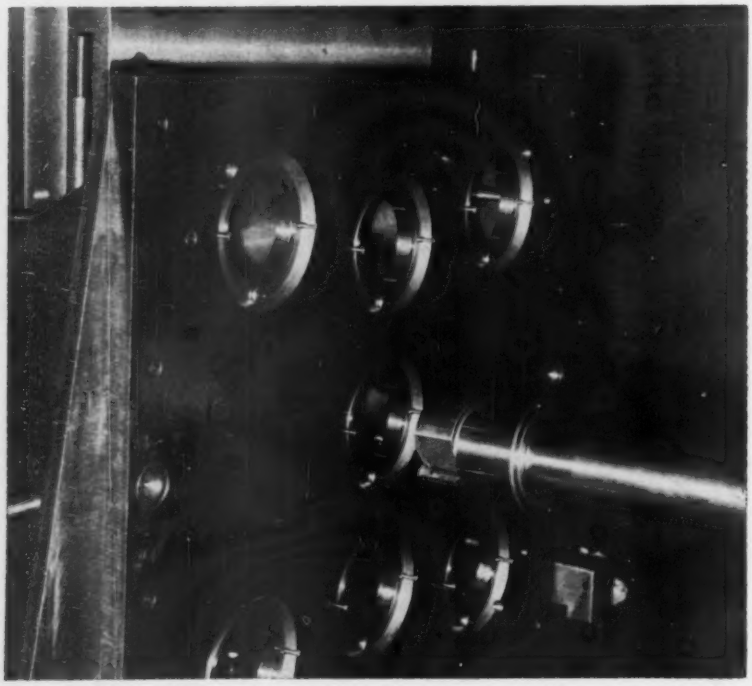
One other cause of trouble, hard water, tends to reduce emulsifying effects and to produce salts. But even here, the change in emulsion concentrate has brought the level of compatability and the level of performance up to a point where there is only a slight rancid odor at any time (mainly after an idle weekend), and even that practically disappears after the system has been in motion for an hour or so.

Totaling up the balance sheet: Pontiac's new higher-cost oil has more than made up for its initial higher expense. •

Trepanning 2- to 5-inch holes



Universal fixture—Slip bushing is concealed by an oil-discharge housing (normally closed by an O-ring and seal). Tubing discharges oil and chips to underfloor sump



Die-plate fixture—Bushing plate has from four to seven bushings to accommodate hole patterns required by several plates. Trepanning gives good hole finish

By Rupert Le Grand
senior associate editor

Team up trepanning bars, a horizontal boring machine, and the right fixtures, and the combination is a winning one. Fellows Gear Shaper Co of Springfield, Vt, which has done more than 50 jobs this way, finds that:

- It takes as little as one-fifth as long to trepan 2- to 5-inch holes as it does to drill from the solid.
- Hole sizes are close to finish size, as compared to holes burned through thick plate.
- Chips are well broken, need not be removed by the operator.
- Trepanning takes less power.

Tooling program

In working up a tooling program, Fellows engineers took into consideration both run-of-the-mill jobs needing one hole, and production work requiring multiple holes (such as die plates for molding machines).

Out of this came standardized trepanning bars, toolholders, and toolbits (see tables and sketches): a universal fixture for miscellaneous work, and die plate fixtures with interchangeable bushing plates.

The universal fixture takes work up to 13 in. diameter by 48 in. long. V-blocks support the workpiece, a slideable box cover confines the oil spray, the bushing plate can be raised or lowered with a screw, and interchangeable slip bushings can be fastened in the bushing hole.

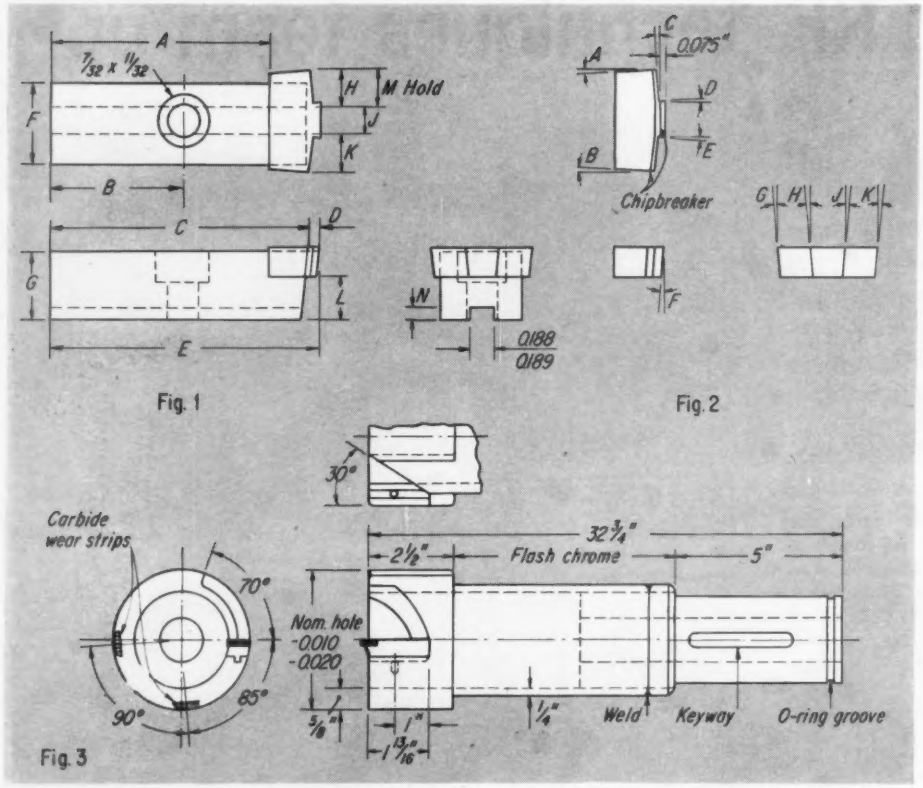
The die plate fixtures have a permanent oil cover, a slot at the top for dropping in the die plate, and a bushing plate with four to seven bushings. Idle bushings are plugged during trepanning, so as to prevent escape of coolant. Die plates range from 33x33 to 36x40 in.

Trepanning blind holes

This operation is started with a spade drill. Then the hole is trepanned progressively by tools that advance in size by ½-inch increments. With this method, all metal is cut into chips, no thin fins remain, and the bottom of the hole can be finished easily.

Gun drilling

Seemingly, the smallest hole size suitable for trepanning is 2 inches



Tooling details—(1) Outer corner of toolbit is referenced to the toolholder keyway, **(2)** two sizes of carbide bits are used, **(3)** shank end of trepanning bar slips into the bar blank and the joint is welded

diameter. For this reason, the machine's high-speed spindle spade-drills holes smaller than 2 inches, and adapters are provided for gun drilling long holes.

Feed rate

Trepanning is limited to 1¼ ipm for 5-inch diameters, and 3½ ipm for 2-inch diameters at average speeds of 250 to 300 fpm, because of machine power. Because the 4-inch spindle boring machine is protected (and limited) by a 25-amp fuse, the operator employs only enough power to register around 23 amps on a meter.

Coolant system

An auxiliary motor-driven pump supplies oil at 125 psi, but this drops to about 80 psi at the trepanning tool. Even so, the oil pressure is sufficient to wash the well-broken chips down a trough and into a underfloor sump. Here, a flight elevator picks up the chips and discharges them into a wheelbarrow.

Tool design

In line with current trepanning practice, 3-step carbide toolbits are used. These bits reduce power requirements, breaking the chips into slightly curled squares (a shape that facilitates flushing out and handling).

Bars are all of the same length, but the cutter head portion is made to nominal hole size (less 0.010 to 0.020 in. for a fit in the fixture bushing). Once the tool passes through the bushing, it guides itself in the hole. A circumferential weld is required because of the two-part construction of the trepanning bar—a bar blank and a shank blank.

Table 1—Trepanning-Tool Dimensions

Hole Dia	A	B	C	D	E	F	G	H	J	K	L	M	N
2 to 2½	1-1/32	⅝				7/16	0.312 0.309	3/16	3/16	3/16	5/32	0.201 0.203	5/64
2 to 4⅜	1-23/32	1	1-31/32	3/32	2-1/16	19/32	0.495 0.500	¼	17/64	15/64	0.330 0.335	0.282 0.284	⅛

Table 2—Toolbit Dimensions

Hole Dia	Carbide Grade	Tip	Angles									
			A	B	C	D	E	F	G	H	J	K
2 to 2½	K21	3/16 x 5/16 x 5/8	1	3	5	5	5	5	2	2	10	10
2½ to 4⅜	K21	3/16 x 3/8 x 3/4	1	3	8	5	5	5	2	3	7	7

Tool grinding

Toolbits are ground in 100-unit lots. A tool grinder with an electrolytic attachment forms the toolbit. A smaller tool grinder, using a diamond wheel with 0.030 to 0.040-in. radius, grinds the 0.060-in.-wide, 0.012-in.-deep chipbreaker groove in each of the three cutting edges. •

Two HERF* techniques team up

Parts that can't be made conventionally seem to be the rule rather than the exception in nuclear reactors. Here is how a job that most shops would shy away from like the plague was licked by combining high-velocity mechanical forging with electro-hydraulic forming

By George De Groat
West Coast editor

More often than not, parts for nuclear reactors must be made to fantastically close tolerances and from materials that can hardly be worked. NTH Products Inc of El Cajon, Calif, recently undertook a job that was no exception: making 50 nested sets of three concentric 180° bend "U" tubes for a commercial nuclear power reactor.

In each set, the two outer tubes are of Zircalloy 4 and the inner one of 304 stainless steel. Concentric spacing of the nested tubes is maintained by dimples which face inward and outward from the middle tube. Outside dimples on the outer tube space the set away from a heavy wall tube that contains the assembly. The inner stainless tube is not dimpled.

Hard-to-hold dimensions

Each of the tubes presents a real problem in holding dimensions: Not only must each tube have a perfectly circular cross-section, it must be a perfect semi-circle, so that it can nest with the others.

The nested assembly of tubes forms a multiple-wall thermal shield (water is the insulating medium). The concentric water purges are only approximately 0.030 in. (the height of the dimples).

The 304 stainless inside tube proved to be no problem, but NTH found the Zircalloy tubes virtually impossible to form conventionally.

NTH farmed the job out to General Dynamics Corp's Advanced Products Dept, San Diego. There, the blanks (0.031-in.-thick ovals about 11¼ by 11¾ in.) were compressed into shallow cups about 1¼ in. deep by 9 in. in diameter, using a closed die in a Dynapak high-velocity impact machine.

Zircalloy cups similar to ones shown at top (cups in photo are actually of 304 stainless) are the first step in making 180-degree tubes for a commercial reactor. Die (below) and Dynapak machine form the cups from 0.030-in.-thick blanks in a single 1/80-second shot. No annealing is needed

The Dynapak's ram is driven by gas under high pressure, traveling at 1500 ips, a velocity that produces tremendous pressure within the die cavity and causes severe deformation of the metal. (The metal moves faster than is possible with conventional methods).

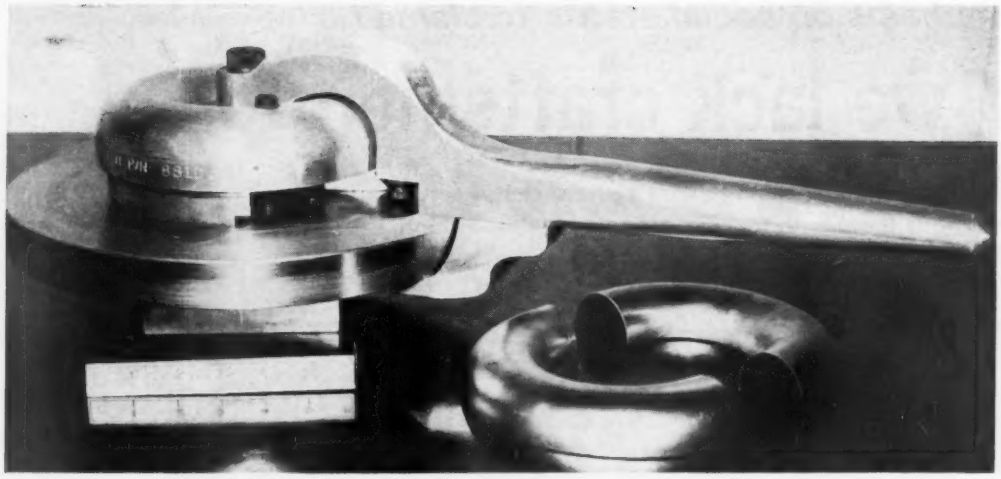
Cleanliness is essential

Because the metal is pulled into the die in compression—and is not drawn—it increases about 25% in thickness. Variations in metal thickness over the entire area of the formed cups amounts to no more than 0.0007 in., the same variation as that in the thickness of the original blanks. One shot in the Dynapak produced each cup in one-eightieth of a second, and no annealing was required.

Cups were then trimmed to remove the flange and center, then were cut in half and TIG welded together to form the 180°-bend tube. A perfect butt match was required in joining the two halves. This was accomplished by a special fixture that aligned the tube halves and clamped them securely.

Because zirconium requires special care in welding (to insure 100% weld penetration, with no voids or inclusions), absolute cleanliness of the joint is essential, as is an extremely pure gas shield. The proper

*High energy rate forming



Formed cups are trimmed to proluce halves of a 180-degree-bend "U" tube. This simple fixture is manually operated to remove centers and flanges by means of roller cutters attached to the handle. Part to be trimmed is confined securely over a hardened steel inner section

atmosphere is achieved by evacuating the purge chamber, then filling it with reactor-grade argon (99.999% pure).

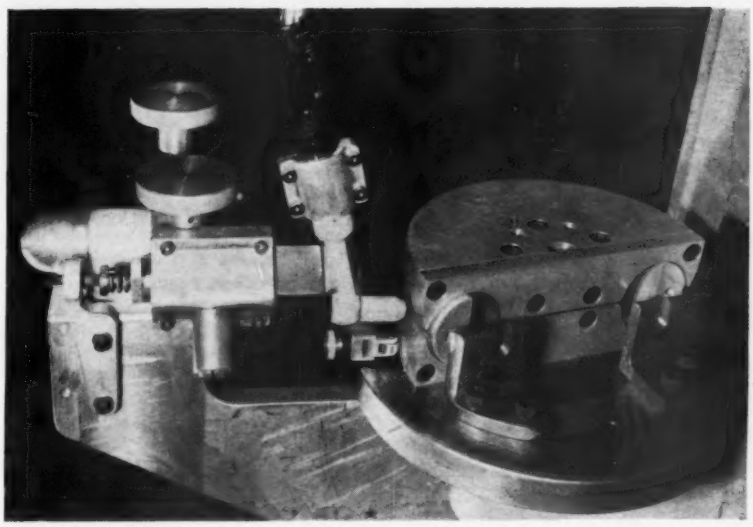
Next, the formed and welded tubes were sized and dimpled. This work was done on a General Dynamic Hivopak, which provides extremely high, non-chemical energy for the exploding wire method of electro-hydraulic forming.

The Hivopak operates from a 110-volt circuit at 7500 volt impulse-release, discharging in about 40 microseconds, to form the work with maximum safety. By presetting the voltage (0-7500), which is read directly from the meter on the console, charging can be controlled at all times.

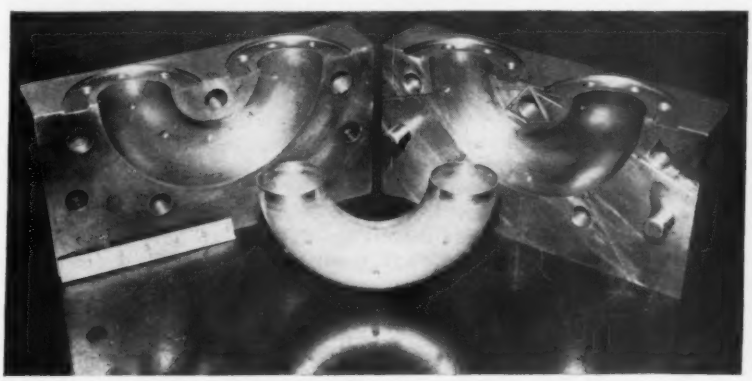
Exploding wire technique

The exploding wire method works this way: A water-filled tube is placed in a closed die, so that the water becomes the force-carrying medium. Electrodes from the energy source are placed in the die (and inside the tube) and are connected by a wire of predetermined diameter, material, length and energy level—factors which determine the amount of force to be delivered.

As the power is discharged, the wire is vaporized and converted to plasma, producting a pressure wave in the water which forces the tube to conform to the shape and size of the die. The Hivopak turns out about four tubes an hour at a cost of less than 0.05¢ per shot. The finished tubes have wall thickness dimensions of 0.030 in. ±0.001 in. and are ready for nesting. •



Joining halves of tubes is of critical importance. This TIG welding setup insures exact mating of the butt joint while work rotates past the welding head. Almost absolutely pure argon shield insures a high quality joint



Hivopak die sizes formed and welded tubes to a wall thickness of 0.030-in. plus or minus 0.001. Dimples formed in tubes in this setup provide accurate spacing

Is overemphasis on social status to blame?

WHY we lack craftsmen today

A veteran machinist looks at management's and society's sense of values—and finds them both lacking. Here is his prescription for lack of new blood in the metalworking industry: a six-year training course with adequate pay

By Ronald G Sealy

We are not even *beginning* to train enough men to fill our present needs —much less future ones.

Machinery, especially today's automated equipment, is by nature complicated, and it will become more and more complex. In just 15 or 20 years, current methods will probably be considered just as out of date as those of the Nineteenth Century are today.

Yet far too few men are being trained to meet the demands of the future. For that matter, there is a vast shortage of truly qualified machinists to meet today's needs.

It is a problem that has concerned me for some time. I do not consider myself an authority on the subject, but as a machinist who has been close to the problem for several years, I get the general feeling of how things are in the trade today—especially in my area (Richmond, Va) and it's certainly not a confident feeling!

What's wrong?

I think the shortage of skilled men can be traced to several things. First of all, wages, though fair for top men ($5000 to $6000) are still too far below the engineering level.

If a man must understand the ideas of engineers *and* manufacture the product, this gap should be narrowed. Many machinists end up doing quite a lot of engineering, especially on new projects: Some even act as engineers, and do a fine job of it because of their experience and know-how. It's one thing to have a theory, but it's quite another to actually make that theory work.

Secondly, there is the feeling that some people have against a man who works with his hands. Many status seekers in our society tend to look down on the blue-collar worker, even though he may earn a great deal more than many white-collar workers, and is the creator of truly beautiful workmanship.

We cannot all be artists in the true sense of the word, but many a man who lanquishes in a white-collar job for which he has little aptitude (and equally little future, for that matter) might have been an "artist in steel" were it not for his prejudice against the blue collar.

Proof? Look at the vast number of white-collar men who relax and forget their frustrations by working with their hands and tools in home workshops. Wouldn't it be better, for many of them at least, to create and build on the job, than to do so merely as a hobby?

The truth is, social pressures have forced many men into jobs with which they are unhappy. I believe that society will be forced to change its attitude toward blue-collar work as time goes on and we are pressed for more skilled men to help in the race to space.

Thirdly, industry is not living up to its responsibilities for training new men. Too many companies take this attitude: "Let someone else do it," or "It costs too much." Does it? I wonder.

We live in a society that prides itself on its accomplishments. Yet great as these are, think how much greater they could be if we would only work together.

For example, if a company trains a man, and that man leaves for another company, there is no reason to look upon his departure as a total loss. The experience and training he has acquired in the first company will help him do a better job in the second, and the whole industry benefits.

Ineffective training

In Virginia we have a State Apprenticeship Council, designed to maintain high standards of training. A lot of thought must have gone into the Council's apprenticeship training program, but it seems to me that in practice several things are wrong with it.

One defect—and quite a big one it is—is that many employers will not hire a man under this program! In a way they are right. The program calls for moving a man every few months from one machine to another—until he has learned to work them all. This is a great waste of money. No one can start something new every few months and still make money for his employer.

For this reason, many an employer starts a man on a machine and simply leaves him there. As a result, he becomes disgusted and quits his job, and sometimes the trade altogether. Perhaps he does stay on the job, hoping to learn more and eventually to earn more, but he seldom gets the chance.

Starting salaries too low

The next objection to the Council's program comes from the men themselves: Starting salaries are too low for apprentices. Most beginners are ex-Servicemen with wives, and sometimes families, to support. At current starting salaries, this is just about impossible. To support a family, the beginning apprentice must take a second job—one that kills his chances to attend night school.

Those men who do not undergo apprentice training, but who like the trade and want to stay in it, find that their lack of training restricts them to semi-skilled jobs and so-so wages, and that they are denied the

chance for higher-paid, more rewarding jobs.

Thus, although these men can be useful to the trade, they are not as productive or helpful as they might be with proper training and better job opportunities. If we are to win the battle for craftsmanship, this is one hole that must be plugged.

Suggested program

One proposal which holds great promise is that we return to indentured apprenticeships—with a modern twist, of course. Under this plan, a man would sign a contract enforceable by law. This contract could be for any agreed-upon number of years (six would seem the most practical).

An average apprenticeship, based on a graduated pay scale, is now four years, but starting salaries are generally low. Why not, then, pay the man at a fixed level for the whole of the six years (this under an indenture, of course)? This fixed wage might equal, say, three-quarters of a journeyman's wage.

Under this plan, the cost over the years would just about equal that of the graduated pay scale, and industry could attract able men who would not otherwise enter the trade. Six years at a fixed salary may sound harsh, but many men give up a lot more than that to enter a profession (doctors make less than $3000 a year during internship).

Naturally, the man would be free to leave when his time was up, but in the six years he would be bound to achieve some status in the company and to have made friends among fellow employees—two factors that make a man reluctant to leave.

Under this six-year program, a man might be given several chances for promotion. At the end of the third year, he could request an interview with a board (made up at the company's discretion) that would judge his qualifications. He could be given a written and oral examination, and perhaps be asked to demonstrate his mastery of several machines, performing jobs on current shop orders.

A passing mark here might mean a promotion to top pay, although it would not necessarily release him from his six-year contract. On the other hand, a failing grade would mean a wait of at least one year before the applicant could take another examination.

Small risk involved

Hiring a man under such a contract would naturally involve some risk to the man and to the employer, but careful screening of applicants, perhaps a release clause in the contract too, should reduce such risk.

The man himself should be given at least a year in which to make up his mind before signing the final papers. If at that time he decides to stay, the contract would become binding for the full six years.

Under this plan, actual training would be geared to shop needs. The man could, for example, go to work on a certain machine at a time when it would be convenient for the shop to train him on it, and he need not spend an exact number of hours on any given type of machine. But under the contract the company should be obligated to train a man well enough so that he could pass a final examination.

Keep him happy

From the company's standpoint, it would be advantageous to keep a valuable employee happy, contract or no. For one thing, this would greatly minimize chances of losing him at the end of the six years. And actual training would take just about as long as do most apprenticeship programs.

The educational level in most shops today is about that of the ninth grade, and among older men this level is even lower. This is a condition that must be changed as metalworking becomes more complex, and if we are to compete economically with fast-paced foreign industry.

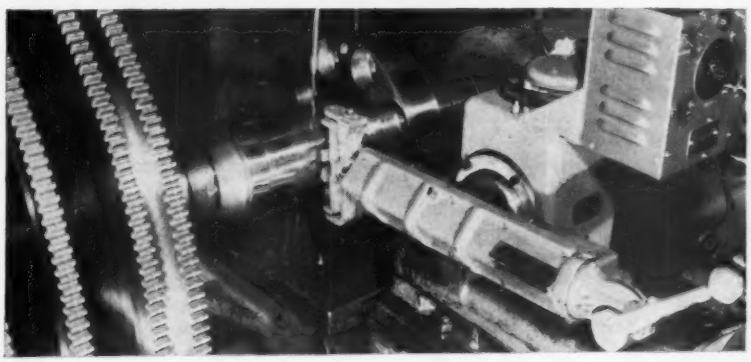
Every apprentice should have at least a high school education to help meet these needs by becoming "artists in steel." •

Oscillating hone speeds finishing

With an ingenious honing device (picture), a Westinghouse plant now finish-grinds a part in one hour. The same job used to take a whole eight-hour shift. The job is grinding rotor journals to size at the Westinghouse Steam Division plant in Lester, Pa. The "Superfinisher" is made by Gisholt Machine Co.

Several models of the Superfinisher are available; range of work handled varies from 3 to 60-in. diameter. Provided with adaptor plates, the portable units attach to the toolpost of any spindle lathe.

Up to four abrasive stones, mounted in a pivoted yoke, do the honing. In journal grinding, these stones are held tightly against the work as it turns; at the same time, the yoke oscillates slightly in the horizontal. The speed and degree—there is a 1/16 to ¼-in. stroke—can be regulated quite easily.



Westinghouse uses the workpiece to dress the stones. To dress the tool to the correct radius, the machine operator wraps the journal with a layer of emery cloth, then turns the work against the stones, until the desired profile is obtained.

After this simple dressing, the honing device is ready for use. Moved by the toolpost along the journal's length, the stones flatten what in a magnified view of the journal surface would look like mountains of metal. •

Putting radioisotopes to work

Once a material is made radioactive, it becomes a real tattle-tale—giving off signals that not only tell where it is and where it goes, but how much there is of it.

Looking for new ways for industry to take advantage of this, H D Briggs and J F Coultry of General Electric's General Engineering Laboratory have come up with some metalworking applications for radioisotopes. Radioisotopes, they found, can:

- Measure tool wear without introducing radioactive material into the machining operation.
- Measure how effectively different cleaning processes remove trichloroethylene.
- Measure the metal composition of parts received from a replacement vendor.

Measuring tool wear

Radioisotopes have been used for several years to give virtually instantaneous measurement of the rate of tool wear. But now, GE's researchers have come up with a new technique that makes it possible to take a sample of chips or punchings from a machining operation, irradiate them with neutrons at some later time, and tell the amount of tool wear for that particular operation.

This technique, "neutron activation analysis," can be used to measure any type of tool wear without the introduction of any radioactive part into the machining operation.

In the test, approximately 100 grams of chips from each machining operation were irradiated for 4 hours with thermal neutrons from GE's 1 mev positive ion accelerator. Previous calculations showed that tungsten could be used as the tool radioactive trace indicator.

To get quantitative measurements, a known quantity of tungsten was irradiated at the same time as the chips. Then, tool wear was calculated by comparing the amount of tungsten in the chips with the calibration sample. A gamma-ray spectrometer analyzed the gamma ray energy spectrum from the radioactive chips and calibration sample. (Results of the cutter tool wear measurements are shown in the table at the upper right.)

Actually, with neutron activation analysis it is possible to obtain tool wear information with only a few grams of chips. This reduces even more the expense and delay of obtaining accurate cutting tool wear or machinability information, and still keeps radioactive material away from the machining operation.

Material	B50A332A			B50A125E		
Cutter type	883	M_2	M_3	T_1	M_2	T_2
Gms of material per gm of tool wear	581	231	326	304	187	328

Cleaning effectiveness

After a part has been washed in trichloroethylene, it is usually considered clean. However, certain component failures were traced to chlorine still present on certain parts after fabrication, and a rapid and sensitive method was needed to evaluate a cleaning process which would remove all traces of trichloroethylene from the parts.

To study chemical cleaning of copper and stainless parts, Briggs and Coultry washed them in irradiated trichloroethylene, performed various cleaning operations on them, and then measured them for radioactivity.

After 50 cc of trichloroethylene was irradiated with thermal neutrons in the 1 mev positive ion accelerator for 80 minutes, the test parts were placed in the radioactive solution and agitated for one minute. The amount of radioactive chlorine remaining on the surface of the parts before washing was measured with a gamma ray spectrometer.

Wash and measure

The parts were then washed with various solvents and again measured for the amount of radioactivity remaining on each part. Quantitative measurements were obtained by irradiating a known amount of trichloroethylene at the same time and making comparative analysis.

The procedure is quite safe because the half life of Cl is 37 minutes and therefore, within a few hours, the chlorine decays to a very safe level. As a matter of fact, the parts used in the test were returned to stock the following day.

The results showed that, while normal cleaning methods were unsatisfactory, additional cleaning or hydrogen firing would remove all traces of chlorine. Thus, with radioisotope techniques, any cleaning process can be quickly evaluated with a high degree of sensitivity.

Vendor checkup

When an operating department of GE had to change core vendors, inspectors discovered that some of the new cores failed to meet electrical specifications when installed in an electrical circuit. However, from visual inspection, the cores appeared to be the same as the original cores. The only difference which might cause variation in the electrical specifications was one of material composition.

GE used a radioisotope technique for non-destructive quality control inspection of material compositions before installation in an electronic circuit. This saved costly electronic evaluation.

Sample cores from both the original source and the new vendor were irradiated simultaneously in the thermal neutrons for one hour in a 1 mev positive ion accelerator. When the elements in the cores were identified with a gamma-ray spectrometer, it turned out that cores from the new vendor contained 4.2% more manganese than the original cores. Since the physical characteristics of both cores were the same, this manganese difference was assumed to account for the variations in electrical characteristics.

Thus, using neutron activation analysis techniques, GE engineers evolved a material composition analysis method that not only correlated composition and electrical characteristics, but which could be applied to all incoming cores as a quality control check on vendor products. •

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Standard Jig and Fixture Parts

Courtesy: National Institute of Jig & Fixture Component Manufacturers

Dimensions for quarter-turn screws and rest buttons have been standardized by the Institute, as the first step in a program to apply standard dimensions and tolerances to all tooling components produced by member firms. The purpose is to lower the cost of tooling and to achieve interchangeability.

It is the Institute's intention to standardize shoulder screws, T-slot nuts, swing bolts, hand knobs, handwheels and other items in the next five to six years. Firms approving the efforts include: Carr Lane Mfg. Co., St. Louis; Jergens Tool Specialty Co., Cleveland; Vlier Engineering Corp, Los Angeles and Downers Grove, Ill.; Universal Engineering Co., Frankenmuth, Mich.; Morton Machine Works, Millersburg, Pa.; Harco Engineering Co, Detroit; Lodding, Inc., Detroit; Monroe Engineering Products, Detroit; Northwestern Tools, Inc., Dayton, Ohio, and Tomco, Inc., Racine, Wisconsin.

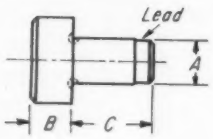
Descriptions of Items

QUARTER-TURN SCREW — This device is extensively used to hold the hinged top plate of a drill jig in position. The device has a threaded shank and a rectangular head. Thickness of the head is equal to the diameter of the threaded shank. This arrangement allows a flat plate containing a slotted hole, the width of which is slightly greater than the diameter of the quarter-turn screw, and the length of which is slightly greater than the width of the head of the quarter turn screw, to slip on and off over the head of the screw. After the plate is positioned over the quarter-turn screw, the screw may be tightened until it clamps against the flat plate.

There are two positions in each revolution of the screw in which the flat plate may be removed. By adjusting the position of the top of the flat plate, or by filing the bottom surface of the ears of the quarter-turn screw, the final clamped position of the plate can be obtained when the ears of the screw are at 90° to the slot in the plate. By turning the screw a quarter of a turn (counter-clockwise), the plate is unclamped and the slot will be in a position such that the plate may be removed.

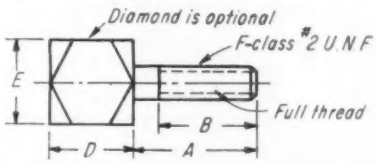
REST BUTTON—The rest button has many uses. It is a hardened-steel cylindrical button with a shank slightly smaller in diameter than the button. The shank diameter is such that it will press into a standard reamed hole. The height of the button is held to a close tolerance.

Rest buttons may be used as resting points for a part where it is desirable not to have the part lie on a large flat surface. Rest buttons may also be used as jig feet. The fact that they are hardened makes them useful in providing a small wear surface. Another application is for hardened cutter sets. The close tolerance on the height of the button makes it possible to press four or more into a flat plate and have their top surfaces in a flat plane. When the buttons are pressed into a surface which is not flat, the tops may be ground to clean up and this provides a flat surface. •



Dimensions of Standard Rest Buttons, Inches

Part No.	A	B	C	D
201	0.1880	0.250	3/8	3/8
	0.1885	0.251		
202	0.1880	0.375	3/8	3/8
	0.1885	0.376		
203	0.1880	0.500	3/8	3/8
	0.1885	0.501		
204	0.2505	0.250	1/2	1/2
	0.2510	0.251		
205	0.2505	0.375	1/2	1/2
	0.2510	0.376		
206	0.2505	0.500	1/2	1/2
	0.2510	0.501		
210	0.3755	0.250	5/8	5/8
	0.3760	0.251		
211	0.3755	0.375	5/8	5/8
	0.3760	0.376		
213	0.3755	0.500	5/8	5/8
	0.3760	0.501		
214	0.3755	0.625	5/8	5/8
	0.3760	0.626		
217	0.5005	0.375	5/8	7/8
	0.5010	0.376		
219	0.5005	0.500	5/8	7/8
	0.5010	0.501		
220	0.5005	0.625	5/8	7/8
	0.5010	0.626		
223	0.6255	0.375	3/4	1
	0.6260	0.376		
225	0.6255	0.500	3/4	1
	0.6260	0.501		
227	0.6255	0.750	3/4	1
	0.6260	0.751		
230	0.7510	0.500	7/8	1 1/4
	0.7515	0.501		
231	0.7510	0.625	7/8	1 1/4
	0.7515	0.626		



Dimensions of Quarter-Turn Screws, Inches

Part No.	A	B	C	D	E	F
101	1	7/8	3/16	1/2	1/2	10-32
*102	1	7/8	3/16	1/2	1/2	10-32
113	1 1/4	1	1/4	5/8	3/4	1/4-20
*114	1 1/4	1	1/4	5/8	3/4	1/4-20
119	1 1/2	1 1/4	5/16	3/4	1	5/16-18
*120	1 1/2	1 1/4	5/16	3/4	1	5/16-18
125	1 1/2	1 1/4	3/8	1	1	3/8-16
126	1 1/2	1 1/4	3/8	1	1	3/8-16
131	1 3/4	1 1/2	1/2	1	1 1/4	1/2-13
*132	1 3/4	1 1/2	1/2	1	1 1/4	1/2-13

*Hardened

250,000 full turns, more than a lifetime of service, and the amount of wear on ratchet drive lugs, or tangs, is practically unnoticeable. Corners remained sharp and clean and the surface unmarred.

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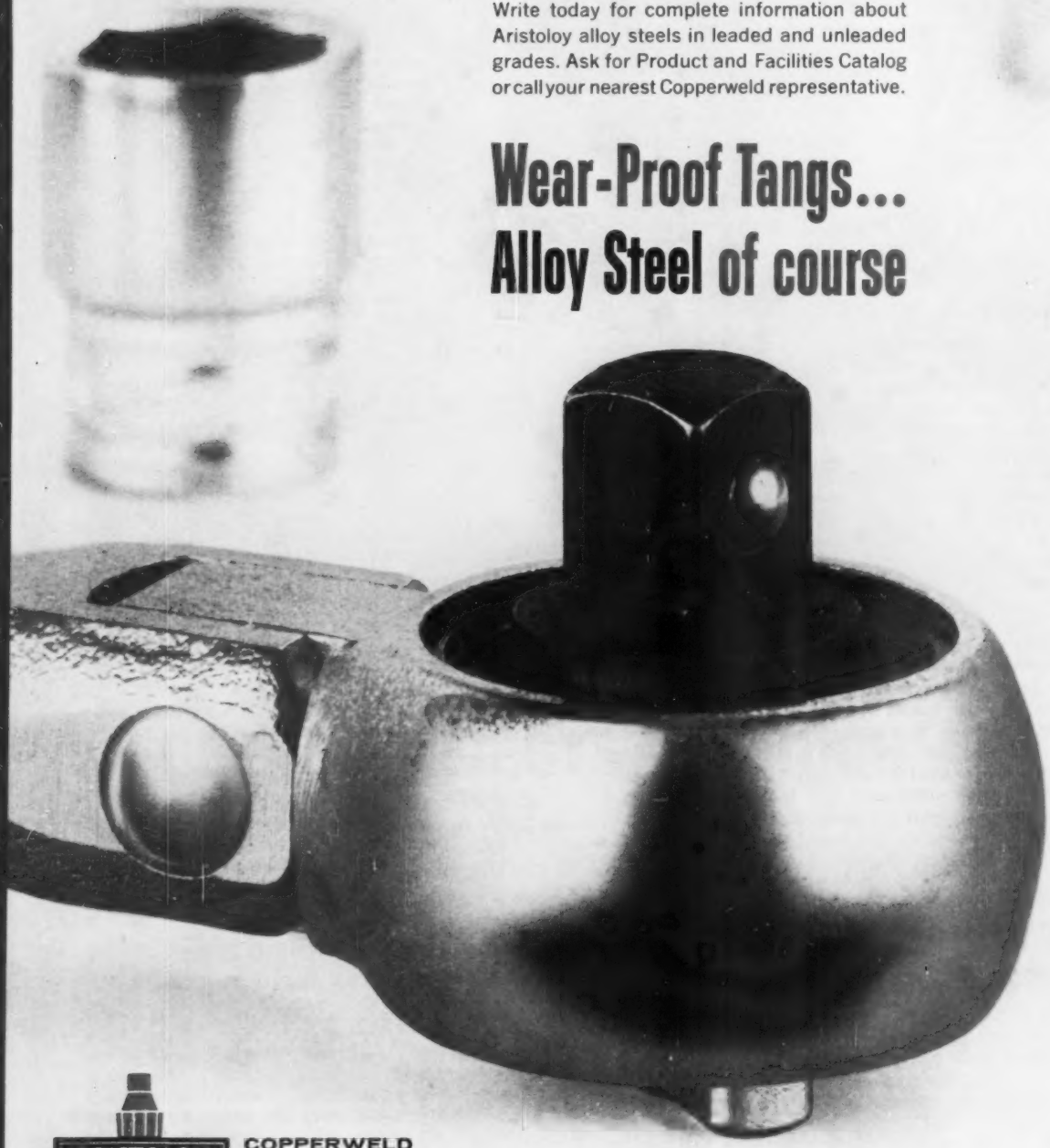

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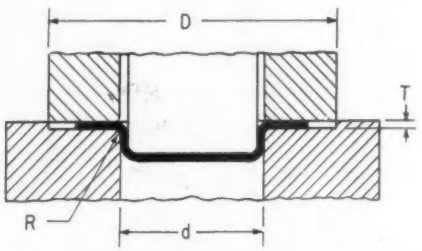
Draw-Die Radius

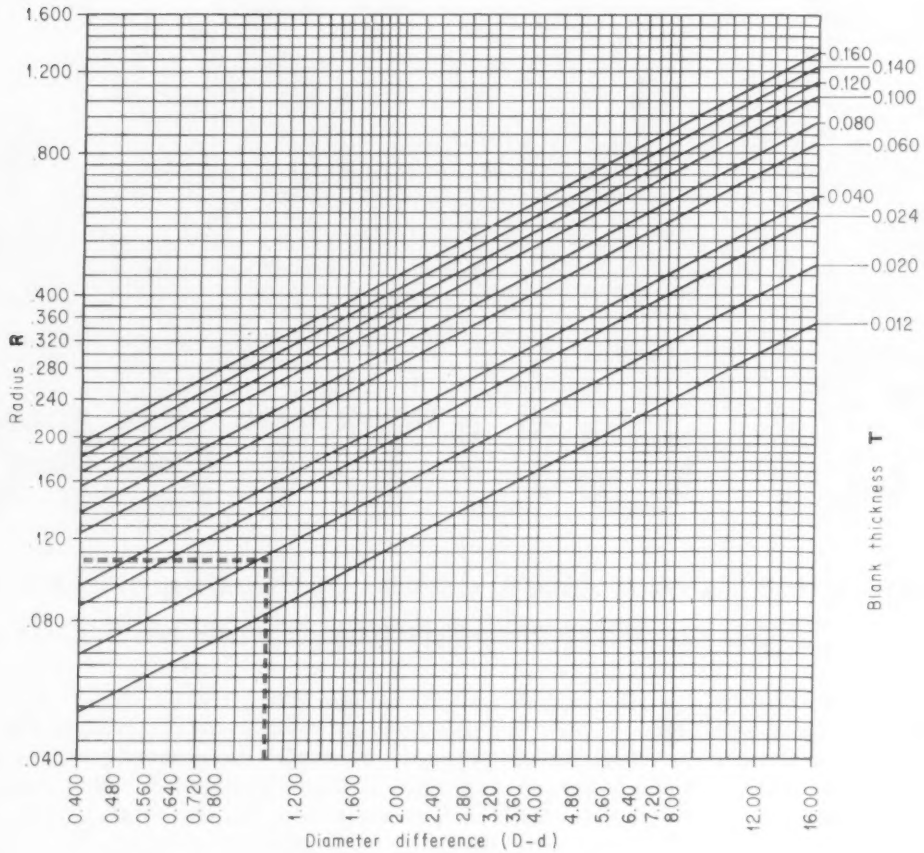
By Ferenc Kuchta, mechanical engineer, J Wiss & Sons Co, Newark, N J

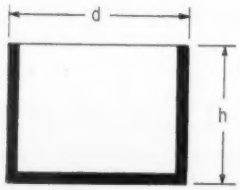


$R = 0.8 \sqrt{(D-d)\,T}$

where D = blank diameter, in.

Tolerance for $R = \pm 0.005$ in.





Example:

$d = 1.00,\ h = 0.75,\ T = 0.020$

$D = \sqrt{d^2 + 4dh} = 2.00$

$D-d = 1$

$R = 0.110 \pm 0.005$

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Talking Shop

Silly Chart

WE ARE STILL in a state of shock from a chart we saw recently showing the growth rate of Gross National Product (the sum of all goods and services) and of money spent on research and development. According to this chart, the R & D expenditures will equal GNP in the year 2015.

That would mean that in a little over a half century we would all have stopped eating, driving cars, or watching TV. We'd just spend all our efforts on research until we starved to death.

We think one of the major research laboratories (which included the chart in its bulletin) would do well to conduct a little research in the use of statistics.

Cover Point Explained

THAT COLLECTION of black circles on the cover of our Oct 30 issue heralding the Special Report on "How to Prove the Profit in Numerical Control," represented a section of standard 8-track punched tape. The message punched in the tape was "N C Profit" with a single punch in track 8 indicating the end of message or return. So it could be read as "N C Profit Return."

There was a good deal of discussion in our office about how many readers would correctly identify the point of the design. The number who did is impressive. We had offered copies of the popular book "Numerical Control for Metalworking Manufacturing" to the first six correct answers.

Our distinguished judge (the author of this column) proves that he is either inept or soft-hearted by announcing that he has 19 winners, each of whom will receive a copy. They are:

Rudolph Berhalter, Reading Pa; J W Bridges, Westinghouse; T R Buckles, Brown & Sharpe; W B Cody, Pratt & Whitney Co; Robert J Fillatti, East Hartford, Conn; C I Hedman, Temple, N H; Stanley P Lydzinskey, United Nuclear Corp; Edward S Kirpas, Farrel Birmingham Co; C Maronn, Pratt & Whitney Aircraft; E W McClurken, Stokes Corp; Robert B Milne, Milford, Conn; E Novak, E Hampton, Mass; Joseph F Onofrey, Westinghouse; Irwin J Paulson, Indianapolis; William L Potter, General Electric; William L Reichenbach, Philadelphia; William C Rosborough, Moline Tool Co; Jack D Selkin, Boston Ordnance District; Gilbert T Thalke, South Bend Lathe, Inc.

After making allowance for the slower delivery of mail to and from the far west, the judge may even select a few more winners, but by the time you read this the "contest" will be long closed. Our congratulations to the winners and a special word to E W McClurken, who answered us in code (see page 58).

Operation Shoehorns

SHOEHORNS may be a by-product of a recent assembly operation at Stephenson-Adamson Mfg Co. The plant has a shop aisle that is 300 ft long and in that aisle a conveyor was assembled that is 298¾ ft long. That sounds like they had 7½ in. to spare at each end.

The conveyor is a natural frequency vibrating conveyor that will collect scrap glass from cutting machines in a new glass plant. It is the longest single vibrating conveyor Stephenson-Adamson has built (and the longest they seem likely to build unless they extend that aisle).

In the natural-frequency vibrating conveyor, incidentally, coil springs all along the conveyor vibrate at their natural frequency and only a small additional power is required to keep them vibrating (as with a clock pendulum) once they have been started.

Long Taper

TOW LINES for aerial target practice get longer as the weapons aerial gunners use get more deadly. Now the Air Force wants a tow line better than five miles long and the tow line gets to be a bit of a problem.

As the result of an earlier study, Southwest Research Institute is now undertaking the production of stranded cables made from wire that is continuously tapered from about 0.050-in. diameter at the tow plane to 0.020 in. at the target. How is the taper made? By electropolishing.

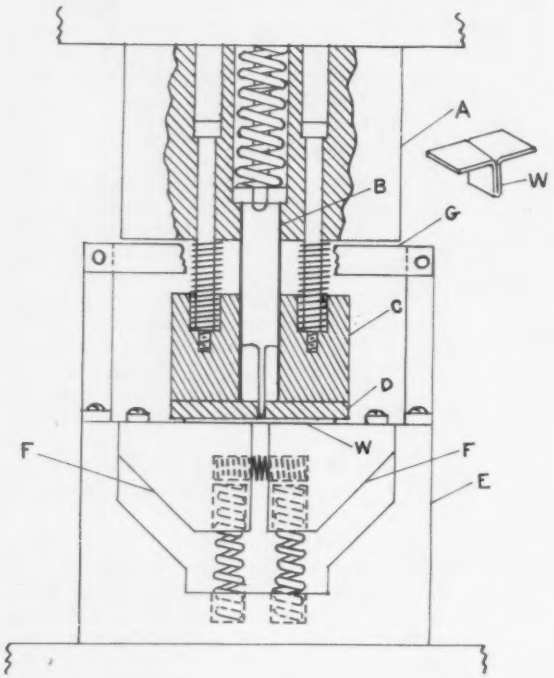
Equality at AC

SEPARATE JOB opportunities for men and women have been eliminated in the new union contract at AC Spark Plug Div of General Motors. Previously, only men were eligible for certain jobs, only women for certain others. Under the new agreement, women will be eligible for all jobs (except those involving physical stress) if they can demonstrate that they have the qualifications.

Neither the company nor the union plans to provide this training at present. The provision was instituted by women members of the UAW on the grounds that they bore the brunt of lay-offs because so many jobs were limited to men. •

Practical Ideas

Die Folds Strip in One Operation



This die was designed to form a folded T-shape piece in a single operation. The block *A* is mounted on the press ram and carries a sliding forming punch *B*, which is backed up by a heavy spring. Two lugs on the punch head project through slots in the front and rear faces of *A*.

Block *C* and the attached plate *D* are connected to *A* by two stripper bolts and light springs. Plate *D* is slotted for the end of the forming punch and serves to prevent the tip from deflecting, as well as to stop the work from bulging upward during the squeeze.

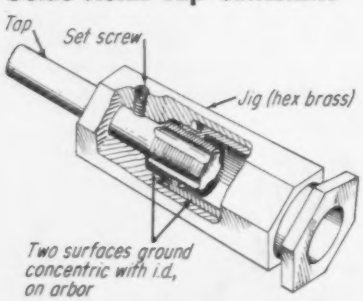
Two bars *G* contact the lugs on the punch head at a predetermined point in its downward movement. The die block *E* is mounted on the bolster plate and carries two squeeze blocks *F* which are held in the up position against stops by two springs, and are kept apart by a transverse spring. These blocks are retained in the die block by two cover plates (not shown).

As the ram descends, the plate *D* contacts the work, and the punch continues down to force the material between the blocks *F* and form a hairpin bend in the center. When the block *A* contacts the block *C*, the lugs on the punch also contact the bars *G*, preventing further downward movement of the punch. Continued downward movement of the ram pushes the blocks *F* down but, as the punch cannot follow, the work is stripped off the punch before the angular surfaces of blocks *E* and *F* make contact. Further downward movement forces the blocks *F* together, thus squeezing the hairpin bend flat. The finished part is blown out of the die by an air jet.

It will be noted that the position of the bars *G* controls the length of the folded section, so this length may be varied by providing vertical adjustment for the bars.

L Kasper, Philadelphia, Pa

Guide Holds Tap Concentric



I had to tap the end of a piece with an 80 tpi tap, and the thread had to be perfectly concentric with the OD. The major diameter of the thread was only 0.015 in. smaller than the OD of the work. To solve the problem, I took a piece of hex brass and bored a three-step hole through it. The smaller diameter was a snug fit for the tap shank, and the other two holes were a sliding fit for the two diameters on the work.

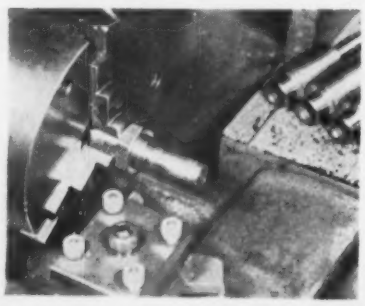
Before boring, I put the tap between centers and carefully ground the shank to be concentric with the major diameter of the thread. Then I pushed the shank into the hole in the guide and locked it in place with a setscrew. I inserted the work into the guide and turned it by hand to cut the threads.

Roger Lawrence, Stow, Mass

Thread Improves Stub Arbor

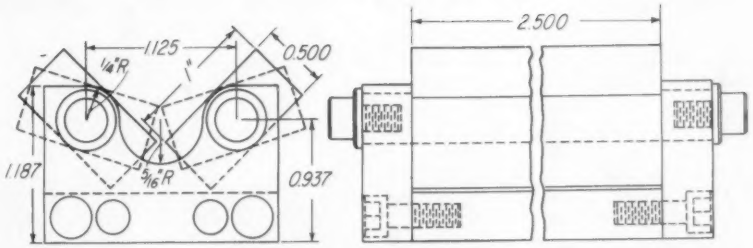
To maintain concentricity between the ID and OD on some short extension shafts that had a blind hole in the end, it was necessary to do the finish turning on a stub arbor that had been machined in the lathe chuck. The shafts were necessarily a snug push fit on the arbor, and it was often quite difficult to pull them off. We got around the trouble by cuttting a thread on the arbor just beyond the holding section, and fitting it with a free-fitting nut. A few turns on the nut cause it to act like a jack and force the work free of the arbor.

J C Magee, Schenectady, NY



Universal V-Block Has Many Uses

Standard V-blocks are indispensable in the shop, but there are many times when blocks with some other angle would be extremely useful. For hex stock you need a 60° Vee for holding with a flat side up, but 120° for holding with a corner up. And if you have to deal with pentagonal stock you are really in trouble. This universal V-block adjusts to any angle and is quite easy to make.



It consists of a base of ⅜-in. CRS, ground all over, and two ⅜-in. end plates, CRS, ground all over. The ¼ and 5/16-in. radii are important as they must clear work lying in the V. The ends are assembled to the base with screws and dowels, and two holes are jig bored 0.375-in. dia through both plates. The blades that form the V are 1 x ½-in. CRS with a trunnion turned on each end and ground on centers to 0.374-in. dia. The blade faces are also ground on centers. The ends are then tapped for No. 10-32 screws. After assembly, the end screws should be tightened and the blades rotated until the faces are parallel to the base, and a light grinding cut taken to make sure they are absolutely square.

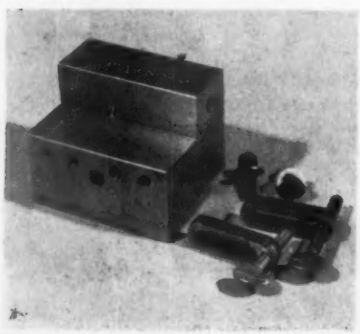
Henry E Piltz, E Orange, NJ

Holding Block Has Many Uses

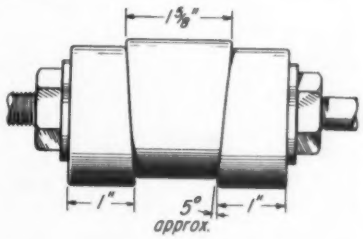
This utility block has many uses for holding round, square, or odd shaped pieces for drilling, grinding, or light milling. It is made of tool steel hardened and ground so that the two inside faces of the cutout are square and parallel to all outside surfaces. Before hardening, holes are tapped for the clamp screws, and two through holes are drilled for mounting the block on an angle plate by means of screws.

It will hold work accurately and securely and, by just turning it over or standing it on end, surfaces can be machined square to each other with a minimum of measuring and checking. To grind angles, the block can be screwed to an angle plate or clamped at the desired angle in a universal vise. The clamps are made of small pieces of tool steel and have slots to permit considerable flexibility of arrangement.

Howard Levy, Brooklyn, NY



Simple Tool Laps Die Bushings



We purchase a considerable number of die sets and always find that some of them will not operate freely because the bushings are too tight. Rather than buy conventional laps, we made up this adjustable lapping tool that is very simple to use, low in cost, and very effective.

For our work we use a half-inch shank and three blocks of neoprene or plastic 2½ in. in diameter. The hole through the blocks is 9/16 in. to permit sideways movement during adjustment. By tightening up on the lower nut we can obtain very fine adjustments to the diameter. The material must be hard enough that it does not compress too easily.

We hold the shank in a drillpress running at low speed, and move it up and down by hand, applying lapping compound with a small brush. There is a small radius on all edges, so even if we accidentally raise the tool right out of the bushing there is no difficulty in lowering it straight back in.

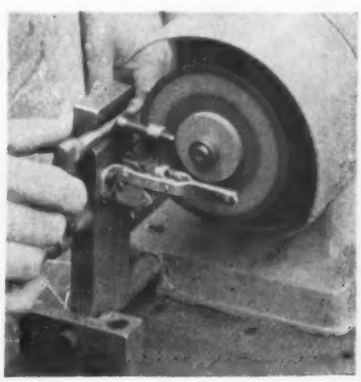
Andre Fars, Quebec, Canada

Cutting Off with Bench Grinder

We have to cut off pins for our dies, ranging from 3 to 14 inches in length. After many near-disasters caused by holding the pins with pliers or bare hands on a regular cutoff machine, we decided to use a spare bench grinder with a simple swing fixture. For maximum rigidity the entire setup is mounted on an iron plate.

The workholding fixture has a deep Vee to position the barstock, and a standard toggle clamp to secure it. It pivots on a pin supported by the grinder base and an outboard block that has a step to prevent it from moving so far back that the work might strike the wheel hub. An adjustable length stop is provided for repetitive work. For a cutoff wheel we use a worn-down wheel from our regular cutoff machine.

Ed Genschel, Clark, NJ



Practical Ideas

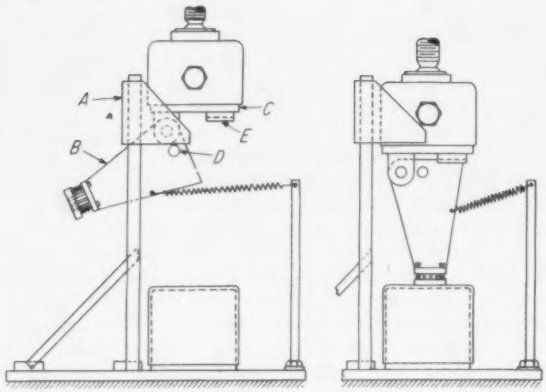
Swinging Punch Increases Work Clearance

A job we had to do recently involved punching four holes in the bottom of a deep, spun aluminum cup. The part had to be lifted over the die, so we needed a press stroke a little greater than twice the depth of the cup. As we did not have a press with this capacity, we developed a swinging punch holder to move the punch out of the way on the upstroke.

The die is mounted on a baseplate which also carries a well supported vertical post to which the bracket *A* is attached. The punch assembly, consisting of four punches and a spring stripper, is mounted on a swinging arm *B* pivoted to the mounting plate *C* attached to the ram.

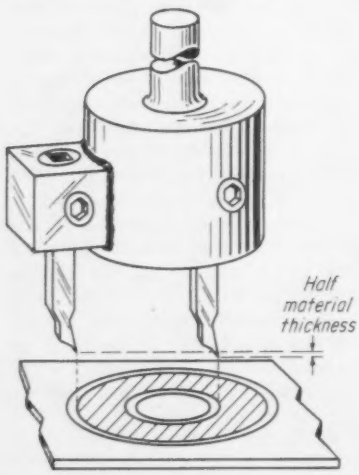
As the ram descends, a strong spring pulls the arm over to the right until the pin *D* clears the end of the bracket. The arm then swings into a vertical position and enters a groove in the stop plate *E* attached to the mounting plate.

On the up stroke, the arm remains in the vertical position until the pin *D* engages the bottom of the bracket, when it is forced to pivot to the left against the tension of the spring and thus provide the clearance.



Ernest Jones, Bronx, NY

Fly Cutter Cuts Micarta



I had to cut a lot of washers, 3 in. OD, 1 1/16 in. ID, out of ⅛-in. thick Micarta. This is too thick to be cut in a die, so I made up a fly cutter that works very well.

The body is a piece of CRS with one end turned down to fit the drillpress chuck. To one side I welded a steel boss. In the body and the boss I drilled two holes to accept square-hole sleeves which I tack welded in place, then drilled and tapped for setscrews to hold the cutting tools. The toolbits are sharpened to a point adjacent to the finished edges of the work to make a nice clean edge. The inner tool projects below the outer tool an amount equal to half the thickness of the work material so the slug will drop free before the OD is cut through.

Setting the tools on opposite sides of the center prevents binding when the tool breaks through. I have used this tool in a drillpress with hand feed, and also in a vertical mill with power feed. It is off balance, but this is not important if speed is slow and the spindle is close to the head. If desired, it is a simple matter to weld a boss on the opposite side for balance. I used a simple fixture to hold the strips of stock.

G Millerwise, Sebewaing, Mich

PROGRESSIVE DIE FORMS COMPLEX CLIPS

Was the winning entry in the Sept 4, 1961 issue.

The $25 prize is awarded to:
HJALMAR DAHL, Upplands Vasby, Sweden

AN EXTRA $25 will be paid for the best Practical Idea in each issue of American Machinist/Metalworking Manufacturing. All items appearing on the Practical Ideas pages are eligible. In case of a tie, duplicate prizes will be awarded.

PAYMENT—will be made as soon as tabulation is completed, and is in addition to the regular rate for the item published.

JUDGES—are a group of American Machinist/Metalworking Manufacturing readers who select articles they prefer in a particular issue. The group changes entirely with each issue and thus represents a true cross-section of readers. Their decision is accepted by the editors, without reservation or bias, as final in each case.

REQUIREMENTS—Items must be submitted by the originator on an exclusive basis. Do not worry about your shortcomings as an author, draftsman, or photographer—every item will be edited in accordance with AM/MM standards, and readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send all entries to: Practical Ideas Editor, American Machinist/Metalworking Manufacturing, 330 W 42nd St, New York 36, NY. Please make sure that your name and address are included.

Names in the News

Philip O Geier Jr

Philip O Geier Jr has been named general manager of the **Cincinnati Milling Machine Co,** Cincinnati, Ohio. He has been associated with The Mill since 1939 and from 1957 to 1960 served as manager of the Products Division. Last year he was appointed vice president and assistant general manager of the company. He is a graduate of Williams College and of the Harvard Graduate School of Business Administration.

Burgmaster Corp, Gardena, Calif, manufacturer of turret drilling machines, has elected **Joseph L Burg** president. Formerly vice president, sales and engineering, he succeeds his father, **Fred G Burg** who will serve as board chairman.

General Motors has elected **James E Goodman** an executive vice president of the corporation with jurisdiction over the Automotive, Body and Assembly, and Parts Divisions. Mr Goodman, a GM vice president since 1952, and group executive in charge of the Body and Assembly Divisions Group since 1958, succeeds **Sherrod E Skinner** who has retired. **Edward N Cole,** a GM vice president, and general manager of the Chevrolet Motor Division, has been appointed group executive in charge of the Car and Truck Divisions Group. Vice President **Semon Knudsen,** general manager of the Pontiac Motor Division, succeeds Mr Cole as general manager of the Chevrolet Division. **Elliott M Estes,** chief engineer at Pontiac, has been elected a vice president of the company and will take over Mr Knudsen's former post.

Monarch Machine Tool Co, Sidney, Ohio, has elected **Kermit T Kuck** (left) president of the company. **Jerome A Raterman,** who has had the dual title of chairman and president since 1957, will serve as chairman and chief executive officer. Mr Kuck, who has been associated with the firm for more than 25 years in engineering and sales capacities, was elected a vice president in 1947, a member of the board in 1954, and executive vice president in 1959. Mr Raterman has been with Monarch for 45 years and has been president for the past 15 years

Mesta Machine Co, Pittsburgh, has appointed **Joseph J Wilks Jr** superintendent of machine shops. Formerly machine shop foreman, he takes over the post of **Max M Kraus** who has retired.

C A Norgren Co, Englewood, Colo, manufacturer of pneumatic products, has named **Delbert G Faust** vice president, engineering. He was previously vice president, marketing.

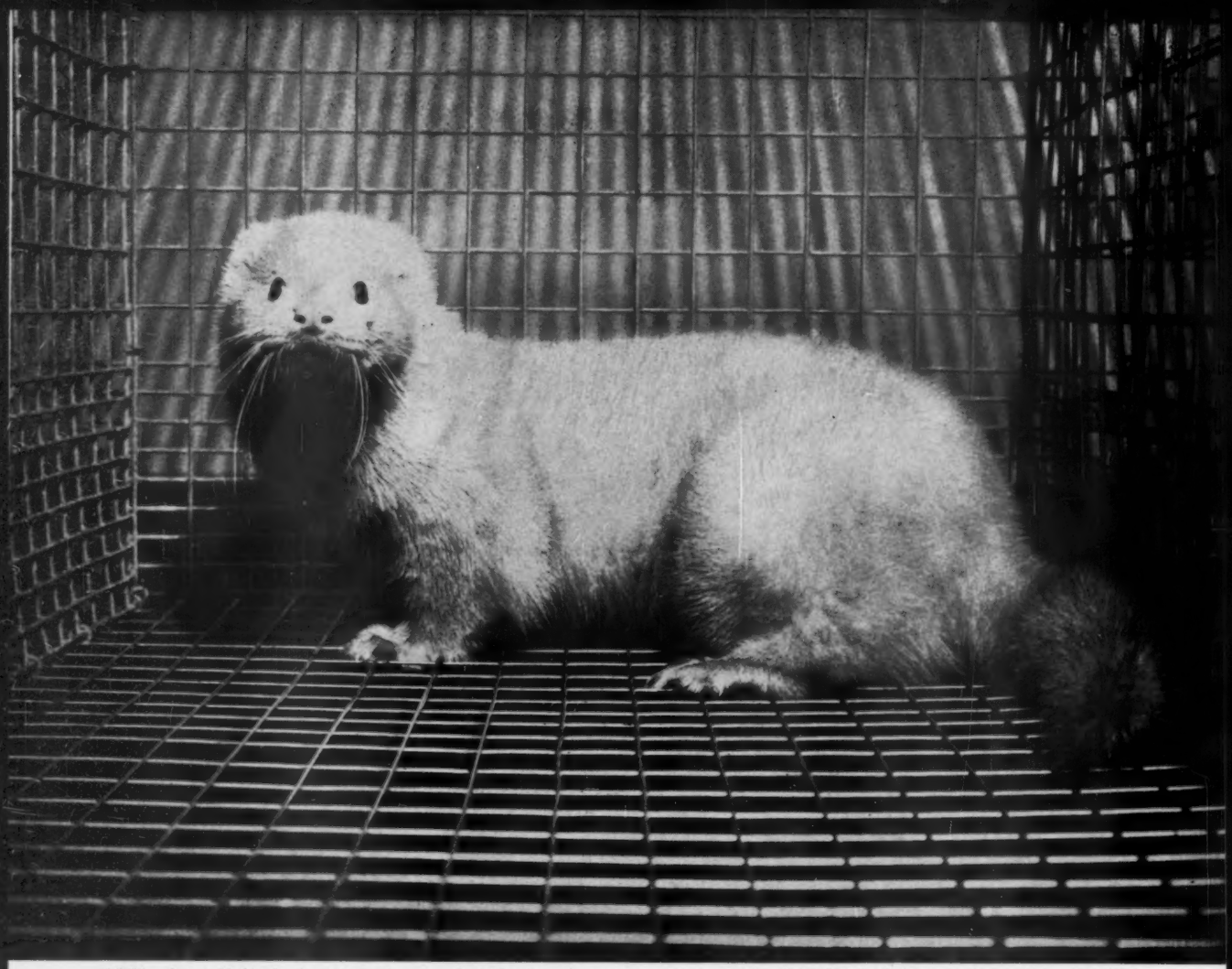
Thompson Ramo Wooldridge has appointed **Stanley F Stearns** manager

(continued on p152)

Michigan Special Machine Co, Warren, Mich, has elected **James F Burkett** president to succeed **Jerome Sullivan,** named chairman of the board. **Fred C Berger** has been elected vice president

Michigan Tool Co has appointed **Richard W Hallock** manager of the Enterprise Division, Detroit. He was formerly assistant to the manager of Manistee Iron Works Division, Manistee, Mich

Norton Co, Worcester, Mass, has appointed **Harold R Montgomery** manager of electric furnace plants for the Abrasive Division. Formerly assistant general manager, he succeeds the late **Howard J Daly**



A full-length coat of light-colored mutation mink requires about 65 pelts, and may carry a price tag as high as $10,000. Individual pelts may be worth as much as $100.

Bethanized steel wire protects her $100 coat

Several years ago, Victor Peternel, a mink rancher in Meadowlands, Pa., was troubled by a costly problem. Rust stains from wire cages downgraded the valuable pelts of his light-color minks, often cutting their sale price in half. Also, he replaced the pens constantly, because ordinary galvanized wire didn't resist the abrasive action of the animals' feet and the harsh corrosion caused by their body acid.

Mr. Peternel, who makes mink cages for his own use and supplies mink wire to other ranchers, consulted with a manufacturer of welded steel wire fabric. They decided to try Bethlehem's bethanized wire, with an extra heavy, C coating of 99.9 per cent pure zinc. After several years the trial cages showed not one spot of rust.

Bethanizing Gives Heavier Coating Weights Than Hot-Dip Galvanizing

Bethanizing, our electrolytic zinc-coating process, makes possible a wide range of coating weights. Including the C coating, four standard weights are available: A; B, twice the A coating; the C coating, three times A; and D, four times the A weight.

Bethanizing also assures complete uniformity, tight bond, high ductility, and ability to withstand severe forming. For more information, get in touch with the nearest Bethlehem office. Or write to us in Bethlehem, Pa.

Here, in one of our customers' plants, is where Bethlehem's bethanized (C coating) wire is made into welded-fabric. It is spooled in 100-ft rolls for such applications as mink cages and chicken pens.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. *Export Sales:* Bethlehem Steel Export Corporation

Steel *for Strength ... Economy ... Versatility*

BETHLEHEM STEEL

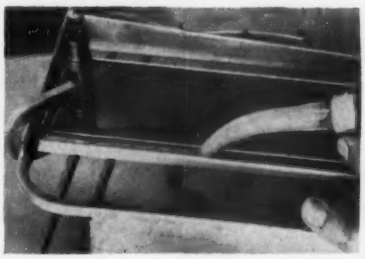
BETHLEHEM STEEL

CIRCLE 327 READER SERVICE CARD

One-Part Epoxy Adhesives Have Unlimited Working Life, Cure in 1 Hour At 350 F

Single-component paste-type epoxy adhesives will not run or flow on vertical surfaces during heat cure. The adhesives, which contain a latent hardener that eliminates the need for weighing and measuring component parts of epoxy and hardener, have unlimited working life and will not harden until heat cured. Cure temperatures of 350 F are recommended but temperatures up to 450 F can be used to accelerate cure times. Cure time at 350 F is 1 hour.

Designed for service temperatures from -70 to 200 F, the adhesives give aluminum-to-aluminum bonds with shear strengths of 3000 to 4000 psi at -67 F, 5000 to 6000 psi at 75 F, and 4800 to 5800 psi at 180 F. Bend strength is 250 lb at 75 F. After exposure to salt spray, water immersion, and 100% relative humidity for 30 days the adhesives give shear strengths of approximately 4,000, 5,000, and 3500 psi respectively, at 75 F.



The adhesives can be applied with a knife or trowel or by high pressure injection methods and need only enough pressure to hold parts together for curing.

Minnesota Mining and Mfg, Co, 900 Bush Ave, St Paul 8, Minn

MORE DATA? Circle 78 inside back cover

File Sharpening Fluid Retains Pitch Angle of File Cutting Edges

Kem-Kut is a new file sharpening chemical that is non-toxic and can be used under normal ventilation and safety conditions. Under the recommended use conditions the rinse solutions can be washed into sewer systems without harm to these systems and the solutions can be used at room temperature.

A test report from an independent laboratory says that the sharpening fluid aids in the formation of a straight, sharp cutting edge in contrast to the ragged cutting edge formed by other acid mixtures.

Steps in sharpening files with Kem-Kut are: wire brushing of files to remove all foreign material, immersion in the solution for 30 minutes at room temperature; and immersion in the company's rust inhibitor, CT-28, with slight agitation.

Features of the solution are that it will not change the pitch angle of the cutting edges (it etches only 1 to 1½ mills from the file surface allowing more than one resharpening in some cases); it will not evaporate or deterioriate in storage, and is not harmed by freezing, and it will not burn the user's skin.

Chem Tech Corporation, Bellevue, Washington

MORE DATA? Circle 79 inside back cover

Marbon Resins Have Performance Similar to Cycolac, Cost 9% Less

The Cycolon line of medium impact ABS (acrylonitrile-butadiene-styrene) thermoplastic resins has generally the same ABS physical properties without the high impact performance of Cycolac brand polymers, and is priced approximately 9% lower.

Suggested uses of the new plastic include refrigeration trays and shelf supports, automotive duct work, knobs, grills, cover plates, housewares, and radio components. The plastic resins are available in standard neutral or custom colors.

Major advantages of the low-priced Cycolon line include, high gloss, fast mold cycling and flow, excellent sheet forming, good profile dimensional control, and high extrusion rates. The product is recommended for sheet extrusion and injection molding.

Marbon Chemical Division of Borg-Warner Corp, Washington, W Va

MORE DATA? Circle 80 inside back cover

Coating Works By Galvanic Action To Curb Corrosion

Devcon Z, a rust preventative paint, contains 95% pure zinc and 5% epoxy binders. The paint seals out moisture and also prevents rust by galvanic action. If the paint is scratched through to the base metal the zinc in the presence of moisture forms a galvanic cell with the base metal (ferrous) in which the zinc will sacrifice itself to protect the base metal.

This protection will last as long as the zinc is present. In addition to the galvanic action the zinc forms a layer of insoluble zinc oxide which further aids corrosion protection.

Supplied in a single container, the paint requires no mixing or preparation and may be appield over rust if surface scale is first removed. It dries to a gray metallic finish in about 30 minutes and because of its high metal content will resist abrasion. Also, it has high electrical conductivity and is recommended for application prior to welding.

One gallon of the paint will coat approximately 1200 sq ft of metal at a cost of about 1½ cents per sq ft.

It is available in 1, 1½, 7, and 27 lb (1 gallon) and larger containers.

Devcon Corp, Danvers, Mass

MORE DATA? Circle 81 inside back cover

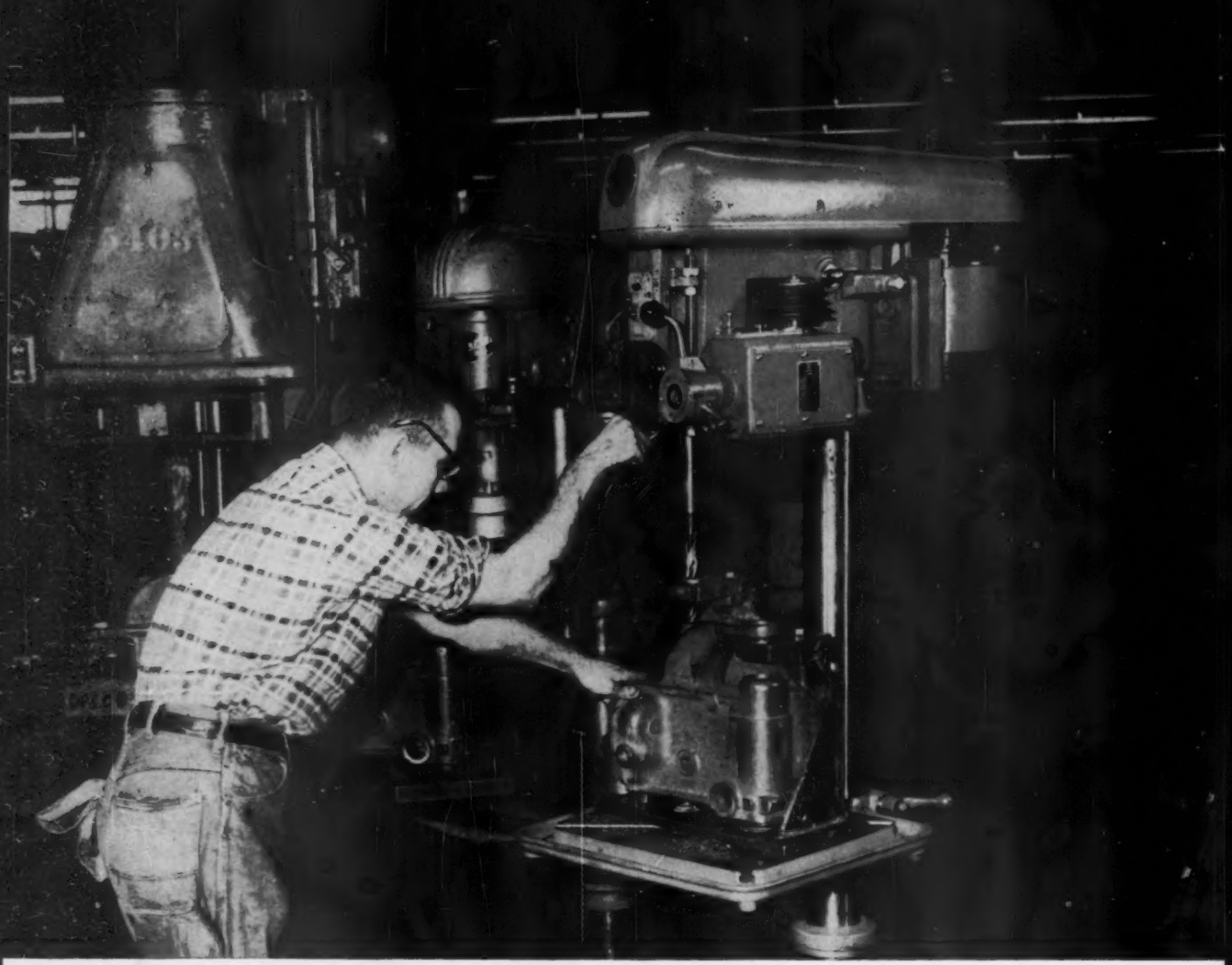
Pressure Sensitive Tape Has Low Friction Backing

Permacel 424, an anti-friction tape made of Teflon with an electrical grade silicone adhesive is recommended for applications where impregnants must be handled.

A class H insulation tape, Permacel 424 is used in the electrical field for insulating coils, transformers, and other high voltage applications. It can also be used to mask parts during electroplating, and for high temperature cushioning and gasketing on flanges and joints.

Permacel, New Brunswick, NJ

MORE DATA? Circle 82 inside back cover



2600 rpm or 110 rpm—you can do more with a Delta 20" *geared pulley head* drill press

All you have to do is turn a key to change from direct belt drive to gear drive on any one of the 28 models of this machine. The 20" geared pulley head drill presses can be used in manual as well as semi and fully automated set-ups to meet a variety of production needs.

FREE BROCHURE describes complete line of 20" drill presses in floor, bench, multiple spindle and overhead models. Write: Rockwell Manufacturing Company, Delta Power Tool Division, N. Lexington Ave., Pittsburgh 8, Pa.

You can drill and tap large holes, do spot facing, reaming and counter-boring at extra slow speeds because these drill presses have planetary gear spindle pulleys which reduce spindle speeds and multiply torque. Hand feed models offer ten speeds, five in direct drive and five in gear drive, while eight speeds are standard on power feed models. Use of a longer than standard belt adds eight more speed selections to either model.

These rugged flexible drill presses have the capacity to handle production metalworking jobs done by machines costing more than twice as much! See them in action and learn how they can help you cut drilling costs and improve drilling quality. Your Delta Industrial Distributor (listed under TOOLS or MACHINE TOOLS in the Yellow Pages) will give you the facts and figures.

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL

CIRCLE 328 READER SERVICE CARD

Ductile Monel Powder Metallurgy Material Operates at 1000 F

New Gramix monel metal, grade 560, with a composition of nickel, 67%, copper 30%, and iron, manganese and silicon shows a tensile strength of 30,000 psi at a density of 7.2 grams per centimeter.

Hardness of parts made with this material range between 50 and 60 on the 15 T scale and radial crushing strength averages 55,000 psi with elongation at about 5%. Because the material is ductile both elongation and hardness values vary depending on the type of processing parts undergo. Modulus of electricity is 15 X 10^6 psi and the yield point in compression (0.1% offset) is 22,000 psi.

The useful operating range of grade 560 is up to 1,000 F and it shows no corrosion effects after extended humidity tests.

The United States Graphite Co, Div of The Wickes Corp, Saginaw, Mich

MORE DATA? Circle 85, inside back cover

Berrylium Nickel Alloy Offered In Strip or Narrow Width Sheet

Beryllium nickel alloy strip or narrow width sheet in several sizes and tempers is now available for firms engaged in product development programs.

The alloy is comparable in appearance to pure nickel or high nickel alloy and has similar corrosion resistance properties. Strength and hardness is high, up to 260,000 psi tensile and Rh 53 C respectively. The material is being offered in four tempers, A, AT, H, and HT with HT having the highest values of tensile strength and hardness.

The Beryllium Corp, Reading Pa

MORE DATA? Circle 86, inside back cover

Primer Converts Ferrous Rust To Iron Phosphate To End Corrosion

Applied by brush or spray to any rusted ferrous metal or galvanize, Zincilate RCP penetrates to the base metal and lays down an iron phosphate coating that severs all contact between rust and metal. Rust is converted into iron phospate according to the manufacturer, and then the liquid forms a moisture proof primer that prevents future rusting. The material does not affect sound paint or galvanized surfaces and is therefore recommended for spot repair work.

To apply Zincilate RCP the only surface preparation that is needed is a simple degreasing; no sand blasting or multi-stage cleaning is necessary.

The rust converting primer is offered as a clear coating and is also available in standard primer colors.

Industrial Metal Protectives, Inc, 401 Homestead Ave, Dayton 8, Ohio

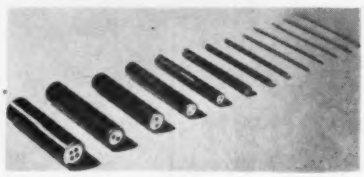
MORE DATA? Circle 87, inside back cover

65 and 75% Low-Impurity Silicon Ferro-Alloys Made Available

Low impurity, 65% and 75% silicon ferro-alloys for electrical sheet steels are now available. The low impurity of the alloys is the result of close control of raw materials in the mix and production of the alloys in a plant restricted to their manufacture. Typical compositions are: 65% ferrosilicon, 65 to 69% silicon; 75% ferro-silicon, 74 to 79% silicon.

Vanadium Corp of America, 430 Lexington Ave, New York, NY

MORE DATA? Circle 88, inside back cover



AEROPAK CERAMIC-INSULATED, metal-sheathed wires are available in longer lengths and closer electrical and physical tolerances than were formerly possible to produce. Special assemblies, such as triaxial and bi-triaxial thermocouples are now possible. *—Aero Research Instrument Co, 315 N Aberdeen St, Chicago 7, Ill*

MORE DATA? Circle 89, inside back cover

Baking Finish Protects Aluminum, Needs No Special Preparation

Uni-Clad formula AD is a stable one-package baking finish for aluminum that is unaffected by salt, fog (5%), and humidity tests of over 2,000 hrs.

The coating won't chip or peel and requires a minimum of surface preparation before application; in some cases only degreasing is necessary.

It is availab'e as clear or in colors and in high gloss or flat finishes.

Universal Paint & Varnish, Inc, 7172 Northfield Rd, Bedford, O

MORE DATA? Circle 90, inside back cover

Low Temperature Steel Blackening Process Inhibits Rust, Corrosion

Orthox, a new blackening process for steel, is said to produce a hard dry corrosion-resistant finish. The low temperature blackener rinses free in cold water and will show no rust or corrosion on treated parts after 180 hours in standard humidity tests. Standard salt spray tests show no rust after 1½ hours.

Since Orthox is a fluid solution with extreme solubility, less dragout of materials takes place during treatment and up to 25% less material is reportedly needed when making additions to the bath.

The black finish left by the process exceeds government specifications MIL-C-13924A.

Du-Lite Chemical Corp, 12 River Rd, Middletown, Conn

MORE DATA? Circle 91, inside back cover

Combination of Molybdenum Disulfide and Teflon Yields Tough, Low-Friction Coating

Molynamel E, a combination of molybdenum disulfide and Teflon, is a lubricant that can be sprayed, brushed, dipped, or roller coated on to any surface to form a low-friction coating that is unaffected by water and practically all solvents. The coating cures at room temperature, in contrast to the 600 to 700-degree bake often required to fuse a Teflon dispersion coating.

In sliding friction tests with two aluminum bars the uncoated bars started sliding at 45 degrees. When one was coated with Molynamel E sliding began at 25 degrees and with both bars coated, at 12 degrees. In addition, the new lubricant reportedly outperformed 28 other lubricants in this test.

For carrying heavy loads the coating can be baked with lamps or in an oven at 300 F for one hour. Service temperatures of the completed coating range from cryogenic temperatures to 400F continuous.

Molynamel E is available in pints and gallons, and in a 2-oz test kit at $5.

The Lockrey Co, Southampton, NY •

MORE DATA? Circle 92, inside back cover

NEW

V-R Boring Bars are micro-adjustable for controlled diameter adjustment

Here's a unique concept in boring bar design that combines a micro-adjustable feature with the economies of throw-away inserts. Fast, simple and positive diameter adjustment in increments of 0.001" save your set-up and production time — bring you greater boring accuracy. V-R carbide "throw-aways" slash tool costs — eliminate grinding, reduce tool inventory and make tool changes easy and fast. A built-in, adjustable chip breaker adapts tools to light, medium or heavy cuts.

V-R Boring Bars replace conventional boring tools, reamers, single-point tools and multiple-point boring heads on hundreds of applications. They are used on automatic or hand screw machines, boring mills, turret lathes and multiple-spindle bar machines. Micro-adjustable styles are available for small hole finishing, shallow boring and deep hole boring. Non-adjustable styles with throw-away inserts are also available.

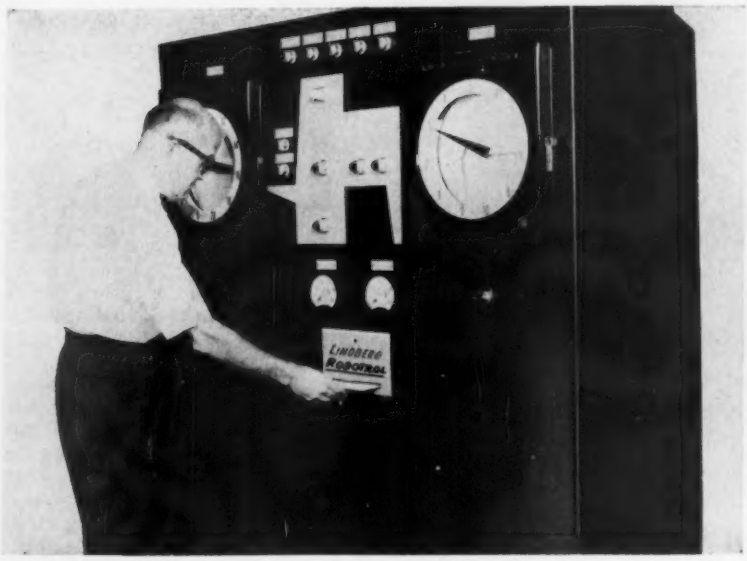
Ask your V-R man how you can profit from V-R micro-adjustable Boring Bars or write for Catalog 6105 today.

VASCOLOY-RAMET CORPORATION
828 Market Street, Waukegan, Illinois

V-R **FIRST CHOICE of more and more plants**

INDUSTRIAL DISTRIBUTORS — THE RIGHT HAND OF PRODUCTION

C-870



Lindberg Robotrol Controls Complete Heat Treating Operation With Punch Cards

A new system for quality control in heat treating, the Robotrol is basically a punch card system. With this furnace control a punch card is the job ticket and specifications are punched into the card instead of being written out. Once the card has been punched it travels with the work to the heat treating furnace and the operator places it in a slot in the Robotrol control panel. The card controls all the operations of the furnace and provides an accurate record of the treatment given the work.

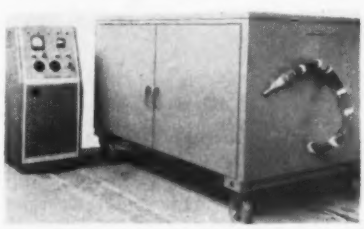
The new system virtually eliminates human error in heat treating. The operator can't put the card in wrong, he can't treat work without inserting the card, and he doesn't have to read or interpret instruments or make any other adjustments.

Typical cycle of controls with the system could be to: set the furnace temperature, set the dew point, set the time after reaching temperature, set the dew point for diffusion, set the temperature at which work is to be quenched, and set the time in the oil quench or atmosphere cooling. If the operation requires cautionary procedures or other operations these can be set also.

The Robotrol can be applied to existing furnaces but is presently being offered as an integrated unit.

Lindberg Engineering Co, 2450 W, Hubbard St, Chicago 12, Ill

MORE DATA? Circle 51, inside back cover



Westinghouse Offers Commercially Packaged Electrohydraulic Machine

Commercially packaged electrohydraulic forming system can store up to 42,500 joules, at 20,000 volts. The machine, which is used to perform the same operations now done on heavy press machinery, can be charged to full voltage in about three minutes, and has a rate of discharge of 33 microseconds per cycle.

The system consists of a bank of low inductance energy storage capacitors, switches for discharging this bank, interconnecting leads, a dc power supply for charging the capacitors, and the controls. The system is packaged in two parts consisting of a control console and a separate modular power unit. Additional modular power units can be added to the single control system for increased system capacity, reliability, or longer life.

Control and auxiliary equipment is guaranteed for one year and the capacitor units are guaranteed for one year or 1,000 shots.

Westinghouse Electric Corp, P O Box 2099, Pittsburgh 30, Pa

MORE DATA? Circle 52, inside back cover

Speedline Introduces Low-Cost Jig, Internal, Contour Grinder

This new low cost machine does precision jig, contour, and internal grinding. Three grinding spindles are available for the machine; air driven, 16,000 to 40,000 rpm, air driven 35,000 to 60,000 rpm and electric driven, 4,000 to 60,000 rpm. The head is graduated 360 degrees with quickset stops for contour grinding.

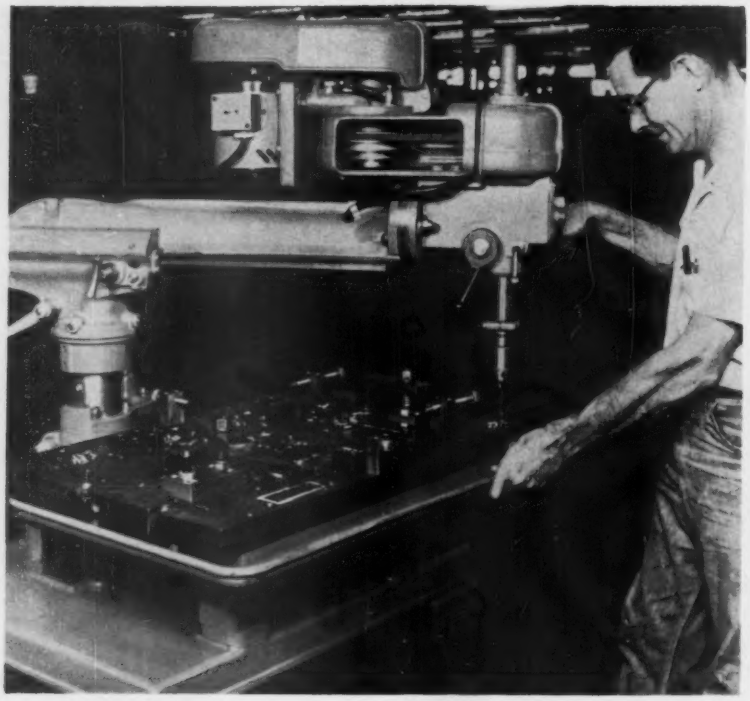
Other equipment includes a quick-setting micrometer depth stop for face grinding, and direct reading lead screws with 0.0001 Vernier for coordinate settings. Wheel outfeed is 0.0001 in. while grinding and maximum movement is 0.50 in.

Tables for the machine come in 10 by 15, 10 by 24, and 12 in., standard work diameter is 5½ in. and adaptors are available for larger diameters.

Prices start at $5,350 for the standard machines.

Speedline Co, 12860 Fisk Ave, Warren, Mich

MORE DATA? Circle 53, inside back cover



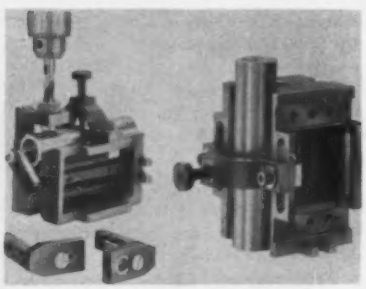
Low-Priced Delta Radial Drillpresses Have 18-in. Head Travel, 360 Degree Ram Swivel

Eight models in the new line of ram-type radial drillpresses are available with either 4¼ or 6-in. spindle travel and standard 30- or 42-in. column length.

The drillpress heads in this line can be moved in and out through an 18-in. travel radius so that drilling can be done to the center of a 62-in. circle. Head, ram, and cradle swivel a full 360 degrees around the column to permit drilling anywhere on the table or on work positioned on the floor. In addition, the head tilts 45 degrees and locks on both sides to prevent angle deviation under heavy loads. Sixteen speeds ranging from 175 to 8200 rpm are available with the 1725 rpm motor. Other features include; one-point spindle lubrication, quill lock controls, six-spline floating spindle and depth gage. Prices range from $760 to $825 without motor and base.

Rockwell Mfg Co, Power Tool Div, Delta, 400 N Lexington Ave, Pittsburgh, Pa

MORE DATA? Circle 54, inside back cover



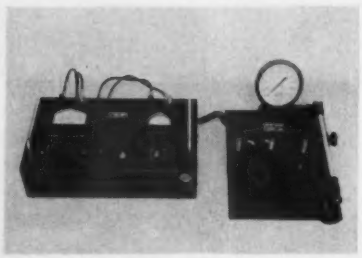
Jig Centers Round, Square Stock In Lathes or Milling Machines

The Multi-Jig which mounts either vertically or horizontally on a drill press milling machine, or the face plate of the lathe, automatically centers round or square stock. It can be used for cutting keyways, straddle milling or slotting and for eccentric turning and drilling. An adjustable stop controls the exact distance of the drilled hole from the end of the stock.

The jig is milled from ductile iron castings with surfaces machined to within 0.003 in. At extra cost it can be obtained with surfaces hardened and ground to tolerances of 0.0005 in. Each unit is equipped with three jig plate brackets machined from one-piece castings with lock screws and type L liners of 5/16, ½, and ¾ in. ID. They accommodate the company's slip-renewable or fixed-renewable bushings in sizes No 80 through 9/16 in. ID. The Mult-A-Jig holds ¼ to 1 in. round stock on one side and 1 to 1⅝ in. on the other. Price for the standard unit is $89.50.

American Drill Bushing Co, 5107 Pacifica Blvd, Los Angeles 58, Calif

MORE DATA? Circle 55, inside back cover



Instrument Checks Cleanliness Of Metals Prior to Welding

Microhm Meter checks aluminum or other metals by measuring the surface resistance in microhms. A low surface resistance shows that oxides or other contamination have been properly removed and that the material should weld properly. Unit operates on 115 v ac and meets Milspec 6858-A.

The test can be performed on coupons cut from the metal and inserted in the test jig, or measurements can be taken directly on the material at the welder head. Jig is hydraulically operated and its capacity range of 0-2000 lb permits duplication of the actual pressures used for the welding operation.

J W Dice Co, Englewood, NJ

MORE DATA? Circle 56, inside back cover

Low Cost Roundness Measuring Machine Checks Within Millionths

Low priced roundness checker is a practical shop tool for determining roundness within 0.00001 in. of internal diameters from ⅛ to 6 in. and for external diameters from 1/16 to 6 in. The British made in-

strument has an air bearing in which a spindle carrying a pneumatic gaging pickup is power rotated at 1 rpm. The air bearing, which requires a working pressure of 60 lbs per sq in., is used to obtain concentricity in the equipment within 0.000005 in. as well as low frictional torque.

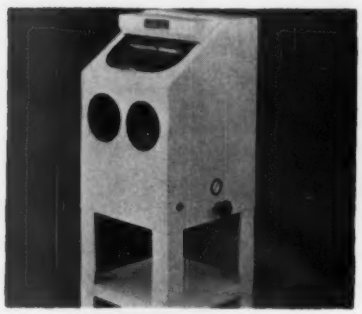
The pickup has a spring-loaded controlling stylus to contact the work periphery and as this stylus moves around the outside of the part to be checked a signal is produced that is amplified and fed to a circular chart recorder.

Magnifications of 5,000 or 1,000 can be obtained with a small knob on the top of the bearing unit and, on a large diameter recorder chart a radial space of 0.05 in. represents 0.00001 in. at 5,000 power magnification.

Flatness can also be checked with this machine with a change of stylus and squareness can be determined before checking for roundness of a part. Price of the machine is $7,750.

Distributed by Bentley Industrial Corp, 21-19 46 Ave, LIC 1, NY

MORE DATA? Circle 57, inside back cover



Liquid Abrasive Machine Handles Parts Up to 12 by 15 in.

Power Blast Model 180, which is equipped with a standard blasting gun and automatic controls, is designed for fine deburring, blending of directional grind lines, removal of tool marks, oxides, scale, or other deposits on precision parts.

Machine is top loading. Air agitation of the slurry is accomplished by a diaphragm-actuated needle air valve. Features include a 160-cfm exhaust fan; a 132-sq-in. reusable mechanical filter; incandescent light; Asco solenoids; remote footswitch; Norgren pressure regulator and gage.

Product Development Co, 3044 E Gage Ave, Huntington Park, Calif

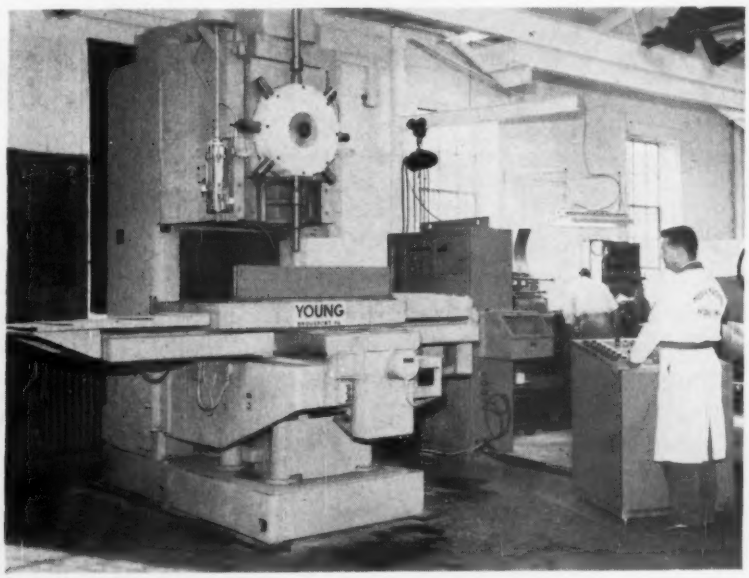
MORE DATA? Circle 58, inside back cover

Ram-Type Bending Brake Operates at 50 cpm

Designed to form flat stock into a multitude of part shapes, the unit has a capacity of up to ¼x2¾-in. cold rolled steel. Machine is powered by a self-contained 7½-hp 2000-psi hydraulic system, acting through toggles to provide greatly multiplied bending force for the ram. Pedestal-type control station actuates the machine electrically. This offset horizontal bending brake produces zero radius bends with consistent accuracy. Sliding ram arm is made of Ampco Metal bronze mounted on tool steel wear strips and adjustable gibs. Dovetail mounted tools slip into the ram and toolholder, speeding setup and changeover. Degree of bend is increased or decreased by hand crank adjustment of this toolholder.

Pine Engrg Co, 601 Walnut St, Aurora, Ill

MORE DATA? Circle 59, inside back cover



Tool Cutting Depth Set to 0.001 in. in 1 Minute on Young N/C Turret Drill

This tape controlled turret drill features the company's patented instant depth setting control which allows tool cutting depth to be set with micrometer adjustment of 0.001 in. in one minute. This is said to reduce the lead time for getting jobs into production and, to also cut down-time since tools can be replaced and re-set in less than two minutes.

The drill, which can be tape, dial or manually controlled, is said to be larger and more rigid than similarly rated equipment (10 hp and 1¼ in. drilling and tapping) and has a larger turret. Both spindles and turret are mounted on pre-loaded tapered roller bearings and no universal joints are used between the motor and the spindle drive. The motor is 2-speed constant-torque type and is connected to a 6-speed gear box which drives the spindles through spur gears and timing belts throughout.

Greater milling capacity than is available on other turret drills is also claimed for this machine. A heavier table with telescoping covers for the lead screws and the way, incorporating narrow guides close to the spindle and close to the center of the dross guides gives strong support for milling.

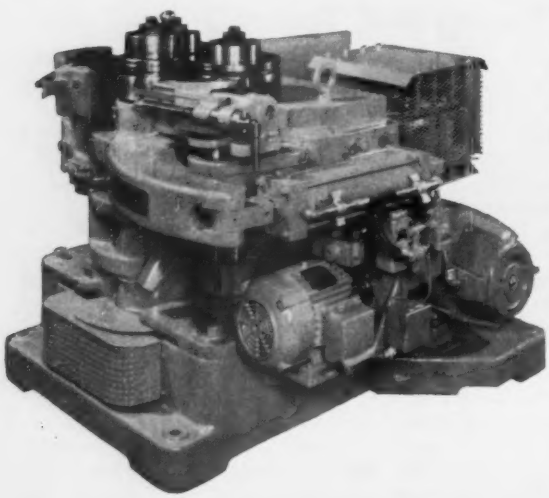
Young Electronic Testing Corp, Church Rd, Box 233, Bridgeport, Pa

MORE DATA? Circle 60, inside back cover

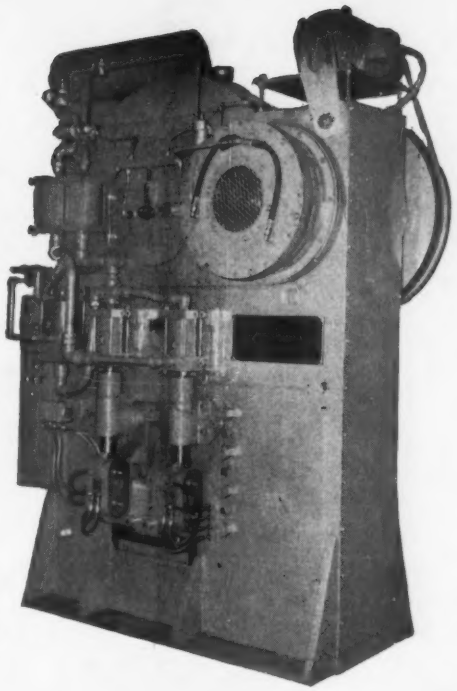
ARE YOU TRYING TO BE COMPETITIVE WITH OBSOLETE EQUIPMENT? Don't get caught in the "profit squeeze" caused by rising production costs. Check into these fast, efficient 'Buffalo' machine tools. Your nearby 'Buffalo' machine tool dealer will be glad to show you how the *right* 'Buffalo' equipment will boost your production and profits. Bulletins are available upon request.

You can't compete when

HIGH-SPEED DIE-LESS COLD METAL BENDING—For fast, commercially accurate bending of tees, angles, beams, flats, pipe and tubing into arcs, segments and spirals — 'Buffalo' Bending Rolls can't be beat. Standard or special rolls are available for any structural shape. One pass completes the job without heat or dies. Horizontal, vertical, pinch type and aircraft models are available in a variety of sizes and capacities. Quality built for a long life of trouble-free operation. For more profitable bending, contact your nearby 'Buffalo' machine tool dealer.



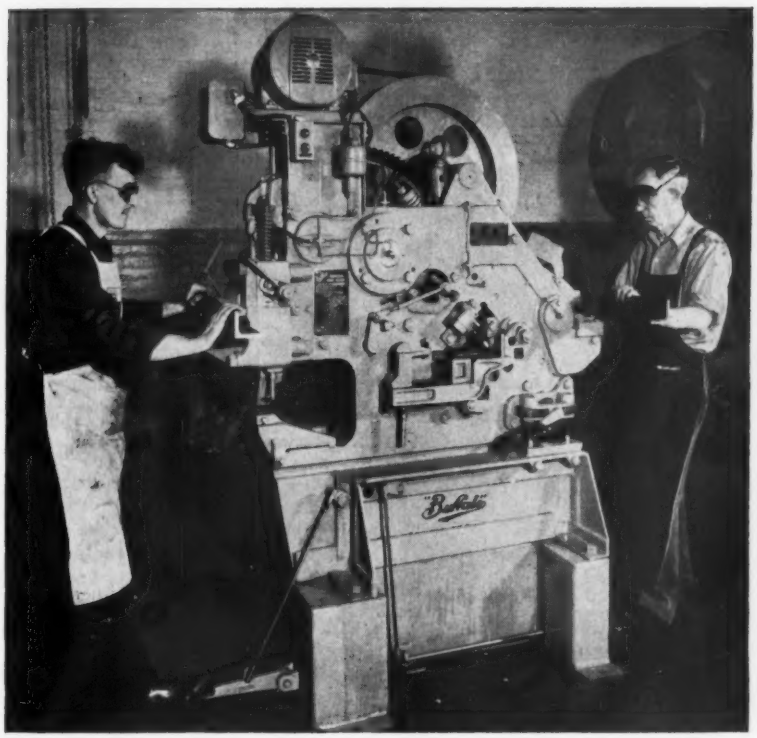
INCOMPARABLE DRILLING EASE, SPEED AND ACCURACY — Beat rising production costs with the rugged 'Buffalo' RPMster. This precision drill gives you instant finger-tip spindle speed control from 90 to 10,000 RPM. Choose from capacities up to 2". Optional hollow spindle (shown) permits use of special new bits for drilling super-hard metals and ceramics. All-geared power feed insures effortless precision. The RPMster is quick and easy to set up . . . table-raising screws and ground, polished ways see to this. Will provide years of trouble-free service.



FAST, CLEAN BILLET SHEARING — With new, high-speed 'Buffalo' Billet Shears you enjoy lower cost per cut. For example, the Number 400 (shown) can give you up to 18,000 cuts per 8-hour shift. And you get clean, square-cut billets. While the 400 cuts any shearable material up to 4½" rounds or 4" squares, other models handle up to 10" rounds. Control is electrical. Frame is rigid alloy steel plate. Lubrication is automatic. Top quality throughout insures long, trouble-free life.

you're obsolete

7 OPERATIONS ON *ONE* FAST MACHINE WITHOUT CHANGING TOOLS — Called "the most useful machine in the shop", the 'Buffalo' Universal Iron Worker helps you slash fabrication costs. In the floor space of only one machine, it cuts, punches, shears, slits, copes, notches, miters. It does two jobs at once . . . quickly handling your angles, tees, beams, channels and bars. The U.I.W. is an all 'round machine — ideal for production or maintenance jobs. See how the 'Buffalo' Universal Iron Worker can save money in your shop. Have your 'Buffalo' dealer arrange a demonstration.



"Buffalo"

MACHINE TOOL DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York

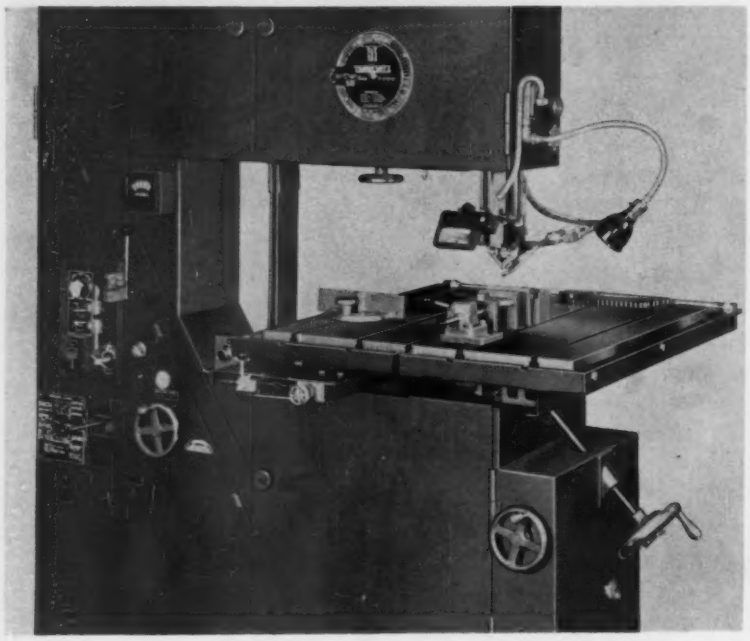
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.



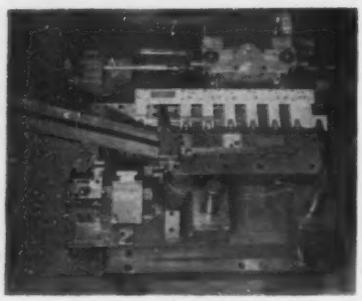
Tannewitz Band Saw Is Hydraulically Powered, Has Blade Speeds to 7500 fpm

Hydraulically powered, variable speed band saw is said to save from 25 to 90% of conventional metal cutting costs. The saw can be furnished with hydraulically powered table tilting, guide post adjustment, saw tensioning, and speed changing. A worm gear transmission supplies any desired speed from 60 to 1000 ft of sawblade travel instantly. For speeds of 35 to 7500 fpm, a 3-speed, shifting-type transmission is furnished. Table travel speed ranges from 0 to 20 fpm and the machine is equipped with a tachometer welder and grinder. A speed selector chart is included that has recommendations for proper saws, saw speeds and for file speeds.

Machines of this type are available with throat capacities of 24 to 60 in. and will handle work up to 13-in. thick.

The Tannewitz Works, Grand Rapids, Mich

MORE DATA? Circle 61, inside back cover



Building Block Transfer Units Allow Use of Less Components

Transfer unit for an automatic valve rocker arm illustrates the flexibility of the building block principle of this type of feed. The workpiece is a modular iron casting that has no work done on its perimeter in this setup. The die is for a coining operation and consists of 4 stations in line and produces 2 pieces every stroke of the ram. It has 2 identical coining stations and 2 identical piercing stations.

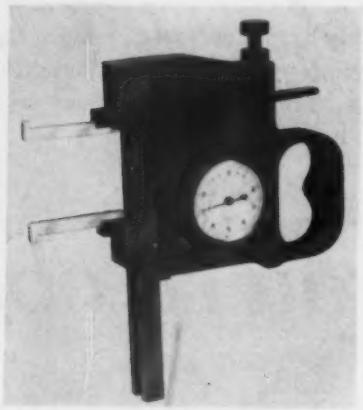
To transfer work only a left hand transfer unit is used and the fingers on one side bring the workpiece against a stationary guide rail on the other. This replaces the normal procedure of having a right hand and a left hand transfer component with the required grasping fingers on opposite sides practically carrying the workpiece from one station to another.

The die is fed through the two paralleled chute magazines that are mounted at an angle. These are linked to the hopper by a connector (not illustrated). The transfer distance is 8 inches with a 2½-in. finger movement and the feed is mechanically operated by the vertical rack from the ram of the press.

At a press speed of 20 strokes a minute this arrangement turns out 40 finished parts a minute.

Livernois Engineering Co, 25200 Trowbridge, Dearborn, Mich

MORE DATA? Circle 62, inside back cover



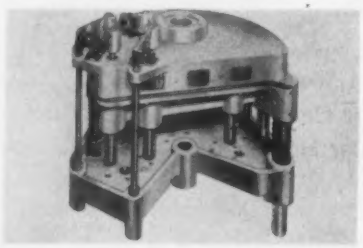
Dial Indicator Groove Gage Measures Internal Grooves

Instrument is designed for production measurement of O-ring, snap-ring, and similar internal grooves in both deep bores and in shallow recesses.

Five standard gaging tips cover the range of O-rings from 6227.3 to 6227-52 and snap rings from 50 to 500. With extensions, the gage can be used to measure grooves inside of a bore 6-5/16 in. deep.

Adam Tool Co, 50 E 11th St, New York 3, NY

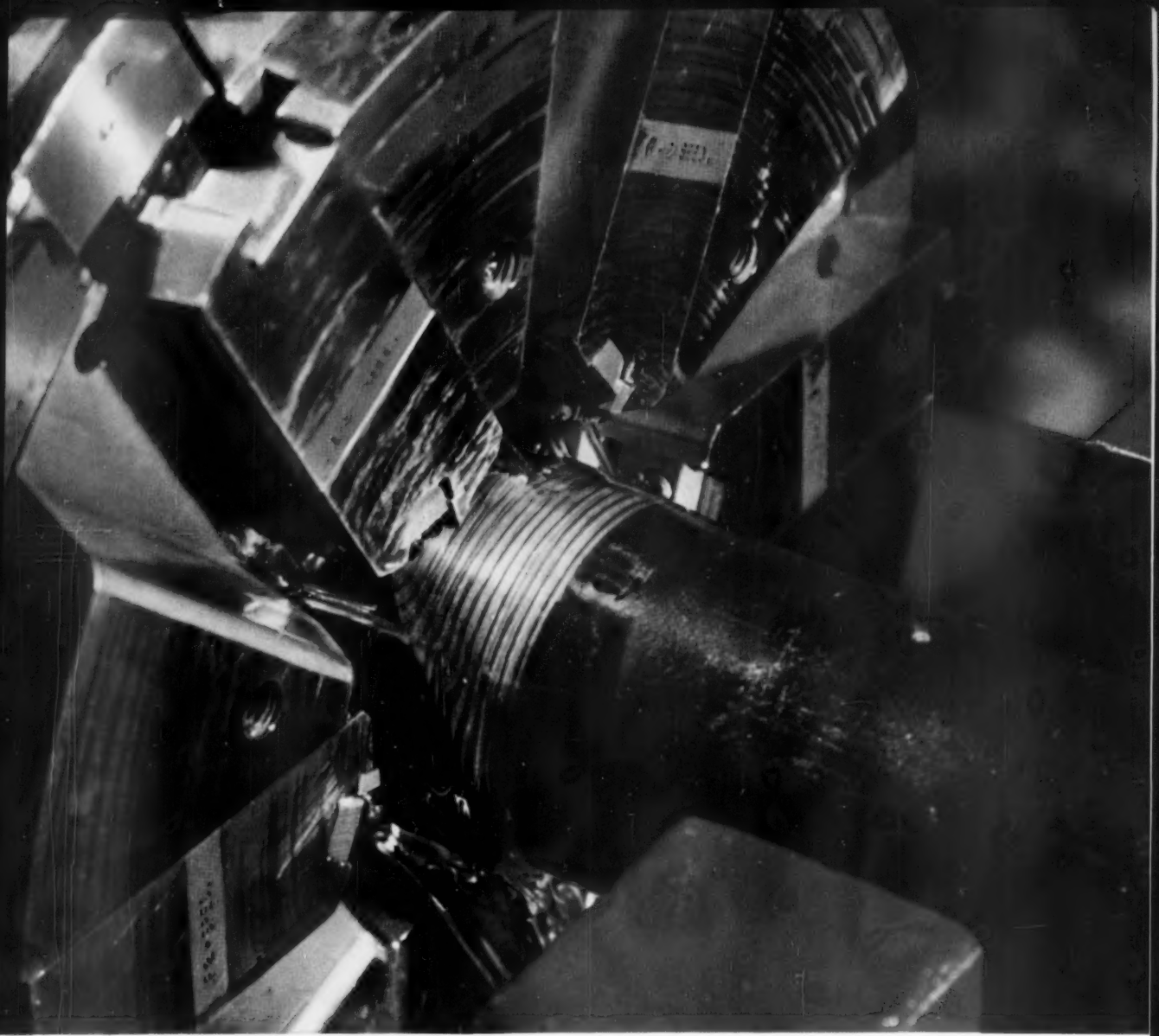
MORE DATA? Circle 63, inside back cover



12-SPINDLE fixed center drilling and reaming head with a bushing plate designed and built for use with a rotary indexing fixture, has spindles with different feed rates. A lever system on the head allows four of the spindles to feed twice as far and twice as fast as the other eight—*—Thriftmaster Products Corp, 1048 N Plum St, Lancaster, Pa*

MORE DATA? Circle 64, inside back cover

CIRCLE 332 READER SERVICE CARD ►



This is just one of the many applications of Sunicut 85, which is one of a whole series of Sunicuts . . . all transparent.

SUNICUT 85 is a heavy-duty cutting oil that lets you see what you're doing

Transparent, fast-draining Sunicut® 85 leaves the workpiece clear for inspection as you go.

Especially designed for use on high-alloy steels, Sunicut 85 is ideal for heavy-duty work on automatic screw machines and production form grinders. It's a natural for pipe threading and similar heavy-duty operations requiring frequent and close inspection.

Easy pumping, fast metal-wetting, and excellent extreme-pressure lubrication are other advantages of Sunicut that lead to production economy for you.

Ask your Sunoco representative about saving money with Sunicut, or write to Dept. I-10.

Industrial Products Department

SUN OIL COMPANY, Phila. 3, Pa.

SUNOCO

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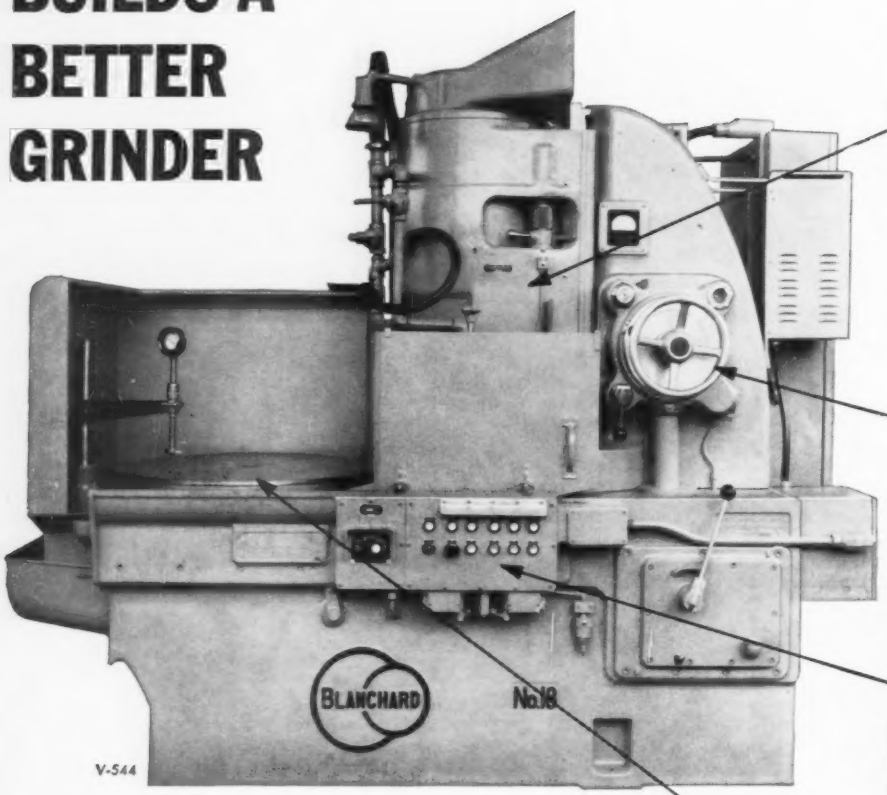
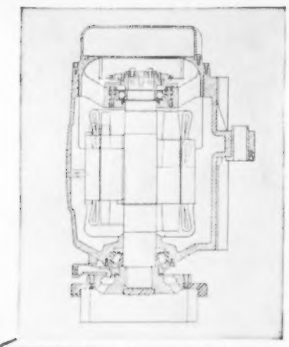
In Canada: Sun Oil Company Limited, Toronto and Montreal

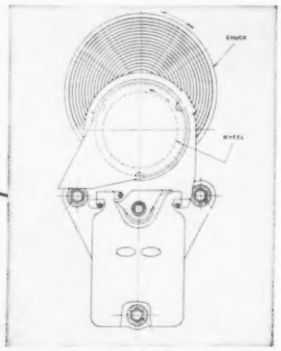
HOW BLANCHARD BUILDS A BETTER GRINDER



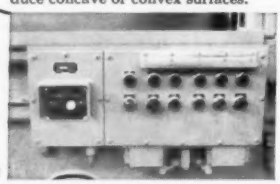
V-544



SPINDLE . . . incorporates a superior, pre-loaded anti-friction bearing system that removes all backlash and radial play. Integral "balanced" mounting of rotor on spindle eliminates vibration.



WHEEL HEAD COLUMN . . . is of heavy box-section design for extra rigidity . . . supported at 3 widely-spaced points. Column may be easily adjusted for alignment. Special column tilting devices available to produce concave or convex surfaces.



V-541

GRINDER CONTROL . . . is compact and conveniently located for fatigue-free handling. All control panels are BLANCHARD manufactured for troublefree operation.

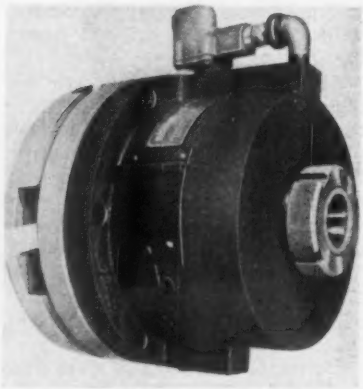
W-949

MAGNETIC CHUCK . . . provides maximum useful magnetic surface . . . has such closely spaced poles, that work as small as a quarter will always touch two or more.

There's no mystery about the *better* performance you get with a BLANCHARD Surface Grinder. It's simply a matter of *better* design of each individual machine part. For example, look at just 4 features of the No. 18, shown at the right.

Get complete details on all 24 models of BLANCHARD grinders. They're today's leading high precision, high production grinders on materials ranging from carbon to quartz . . . from bronze to steel. You can handle parts ranging from tiny jewels to giant plates up to 108″ across corners.

PUT IT ON THE BLANCHARD **THE BLANCHARD MACHINE COMPANY**
64 State Street, Cambridge 39, Massachusetts



Erickson Redesigned Air Chuck Allows Work To Pass Through It

Redesigned '09 air-operated chuck has a "doughnut" piston design that permits bar stock to be passed completely through the chuck. The chuck accommodates the company's standard double-angle collet and gives 1/32-in. collapse, accuracy in tenths, and uniform gripping power the length of the collet.

Because the outer housing of the chuck does not rotate, rotary air connections are not needed and the chuck can operate in areas of small clearance.

The chuck is made in three sizes, 7½, 8¾, and 10 in. dia which will hold work in sizes from 2.125 down to 0.468 in dia. Special collets allow work of 0.093 in dia to be gripped.

Eric Tool Co, 23350 Solon Rd, Solon, Ohio

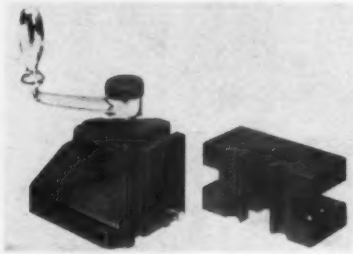
MORE DATA? Circle 65, inside back cover

New Box and Pan Brake Has 36-in. Capacity

Features of the PX36 include frame of rigid box construction; finger bar that provides 1-in. clearance between frame and fingers, adjustable for stock thickness; back gage, a flip-over finger gage for full range 0 in.-24 in. with minimum thickness material; stop collar, quick-set, infinitely variable, positive setting 0°-135°; capacity, 16-gage mild steel. Unit is available for bench mounting or with a steel cabinet floor stand.

Peck, Stow & Wilcox Co, Southington, Conn

MORE DATA? Circle 66, inside back cover



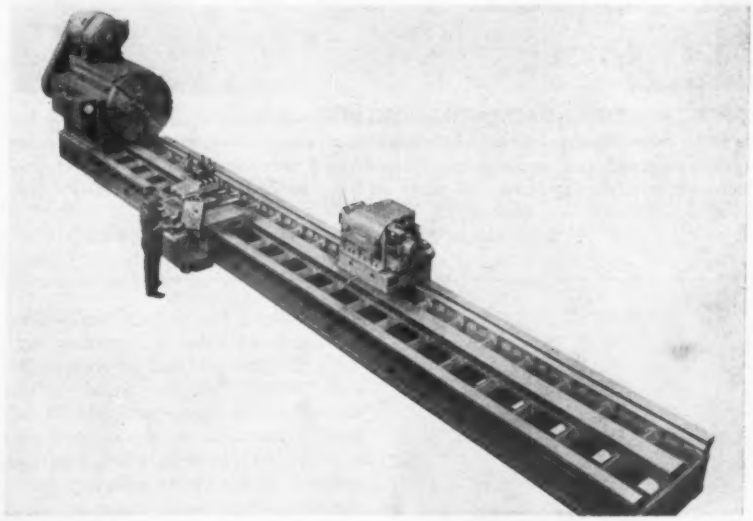
New Toolholder Ups Production Output

Output of lathes and other machine tools used on production jobs can reportedly be increased 100% with the use of the Manco Quick Change Toolholder. Method of locking adaptors into place assures repeatability. The unit is built so that the master base contains a dual set of rails which mate positively with ways on the tool adaptors. A draw plate which functions with a rearward action engages the adaptors with uniform pressure to zero tolerance.

The base of the unit is drop forged from 1040 steel, heat treated, and grooved on the bottom to establish a firm grip to the lathe compound. Optional device available is an air-operated locking attachment which locks or unlocks the toolholder with the operation of an air valve lever. Three models of the toolholder are available for use on lathes ranging from 9 to 20 in.

Manco Tool Co, 820 S Mariposa St, Burbank, Calif

MORE DATA? Circle 67, inside back cover



Farrel-Betts Heavy-Duty Lathes Designed For Addition of Numerical, Tracer Control

Available in sizes ranging from 32 to 92-in. swing over the bedway these new heavy duty general purpose and roll turning lathes have carriages arranged for the application of numerical and/or tracer control. The Rotorak feed incorporates a sectional threaded rack with a pair of large, adjustable screws for backlash control. And since the rack sections are short and accurately spaced there is no limit to the length of bed that can be supplied.

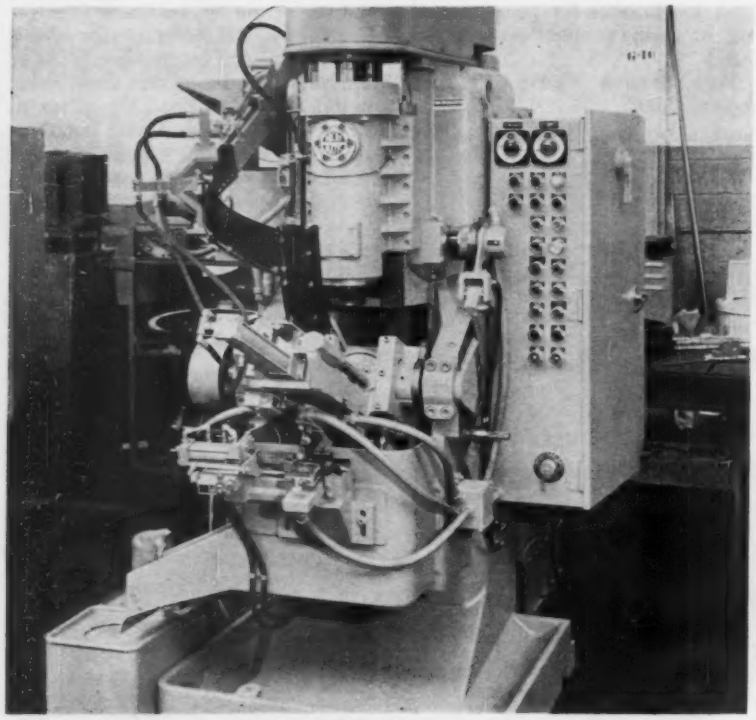
Carriage can pass the tailstock as well as the steadyrests and this results in less setup time, particularly when two carriages are used on long lathes, or when work ends must be faced.

From the carriage the operator has centralized control of all operations and can observe the cutting tool at all times.

Headstock spindle, driven by a dc adjustable speed motor with a 4 to 1 speed range has four mechanical speed changes for a wide range of operating speeds.

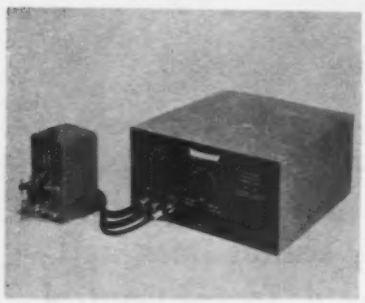
Farrel-Birmingham Co, Inc, Consolidated Machine Tool Div, 565 Blossom Rd, Rochester 10, NY

MORE DATA? Circle 68, inside back cover



SPHERICAL-MILLING MACHINE rough mills full-end and truncated spheres prior to finish-microhoning. Machine incorporates a special integrated hopper-loader system that reduces loading time from 4- to 5 seconds to only 1 second and increases productivity from 240 parts an hour to 260—*Micromatic Hone Corp, 8100 Schoolcraft Ave, Detroit 38, Mich*

MORE DATA? Circle 69, inside back cover



Dual-Range Electronic Welder Is Two Power Supplies in One

Model 1059 is a solid-state, capacitor-discharge welder power supply with full circuit switching for each of two ranges. Maximum versatility in this voltage-regulated unit is achieved by rapidly switching from a low range of 0.04 to 9 watt-seconds to a high range of 0.2 to 45 watt-seconds as required.

Output energy is maintained within $\mp 1\%$ for voltage regulated input variation between 100 and 130 v ac. Discharge time is approximately 0.001 second. Model 1059 meets all specifications for voltage regulation. No warm-up time is necessary, and both this model and a companion unit, Model 1058, are based on the asymptotic charging principle. Model 1058 is identical to Model 1059 except for voltage regulation. Controls include stepless heat selector; watt-second meter; range selector; weld setup switch; and on/off switch. The 1058 is priced at $375; the 1059 is $440 fob.

Weldmatic Div, Unitek Corp, 950 Royal Oaks Drive, Monrovia, Calif

MORE DATA? Circle 70, inside back cover

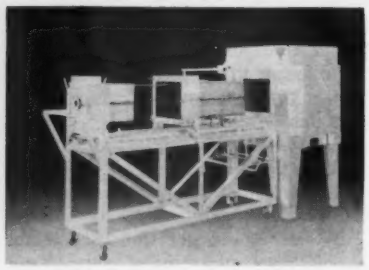
Automatic Torch Cuts Back Fuel and Oxygen Consumption

New 18-2F, reported to offer users up to 50% reductions in gas and oxygen, incorporates a serrated thumb-control switch, which when turned to the off position, reduces the flame to a pilot light. Flicking the control to on restores the original preset flame.

Also designed into the torch are high-temperature silicone O-ring seals for fast change of tip assemblies. Its universal mixer takes the first 12 Harris tip sizes. Welding tip assemblies 15, 19, and 22 have individual mixers for maximum operating safety. Company's H-43-4 Multi-Flame heating assembly can also be used with the torch as well as the Model 73 cutting attachment that cuts thicknesses up to 6 in.

Harris Calorific Co, 5501 Cass Ave, Cleveland 2, Ohio

MORE DATA? Circle 71, inside back cover



Unit Converts Furnace To Controlled Atmosphere Operation

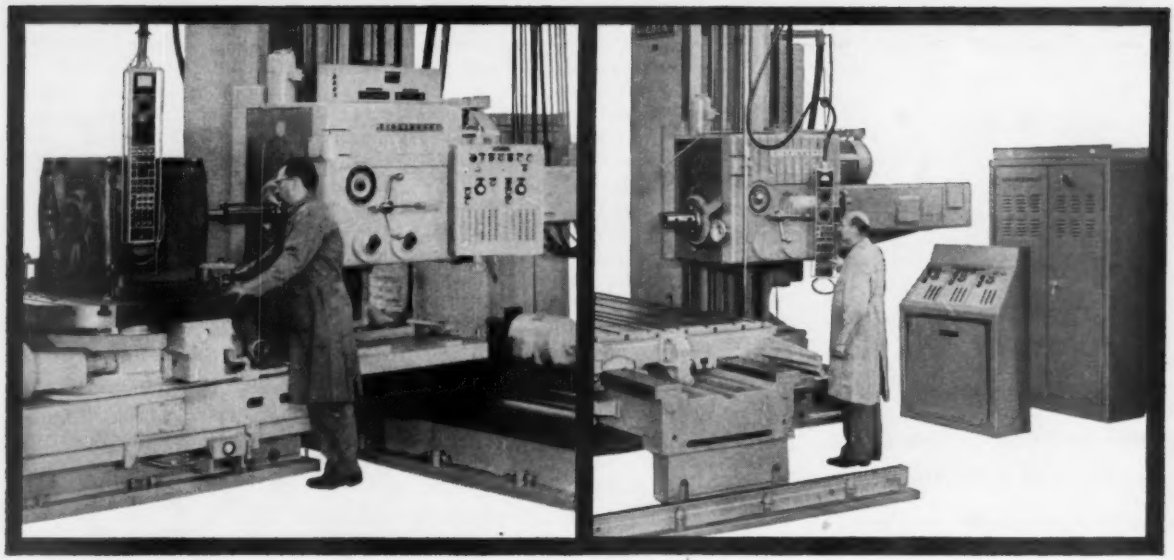
A unit consisting of an alloy retort mounted on a movable rack fitted with casters provides for retort heating in a standard Pereco general-purpose furnace. When the main furnace door is open and swung out of the way the conversion unit is wheeled in and locked into place. The furnace is then ready to perform work in a controlled atmosphere at any temperature up to the capabilities of the alloy muffle. The silicon carbide furnace hearth which serves as a muffle support can be used as the load support when the furnace is required for more conventional purposes.

The muffle wheels away from the plug type muffle door which is fastened to the rack during loading. This eliminates handling the heavy plug door. For protection of the muffle and the furnace, the plug door is spring-loaded to serve as a pressure release if an explosion occurs.

With two or more of these conversion units the furnace can be continuously operated; one rack being loaded while one is heated, and one is cooling.

Pereny Equipment Co, Inc 893 Chambers Rd, Columbus 12, Ohio

MORE DATA? Circle 72, inside back cover



Gilbert horizontals make the most of tape

Increased output per man and machine, improved and uniform accuracy, reduced tool and fixture storage, reduced parts inventory, shortened lead time, fewer inspections—all make a tape-controlled horizontal pay for itself fast, *if the horizontal is built to work with tape.*

To get increased output, your horizontal must be basically designed (as a Cincinnati Gilbert is) to take increased operation. To get improved, uniform accuracy, your horizontal must be built (as a Cincinnati Gilbert is) to eliminate uneven wear of ways, guides, and screws.

Tape can be "tacked onto" any horizontal boring mill; but it will pay off best when it is teamed with a Cincinnati Gilbert, designed to make the most of tape.

New 4″ and 5″ series are built for tape

Both the new 4″ and 5″ series, table and floor type, are designed—from foundation up—to match the potential of tape. Exclusive LIFE-LIGN construction of ways and guides eliminates cocking of all moving units. No matter how hard you run a Gilbert under tape, you can be sure that every unit moves straight and smooth as the tape commands.

Spindle diameters are 3½″, 4″, or 5″. Vertical and horizontal travel of units can be varied. Multiple work stations increase production.

You can get any degree of numerical control you need, from simple dial-in operation to three-axis control of the machine and automatic table indexing.

Write for new literature. The Cincinnati Gilbert Machine Tool Co., 3366 Beekman Street, Cincinnati 23, Ohio.

Cincinnati

GILBERT

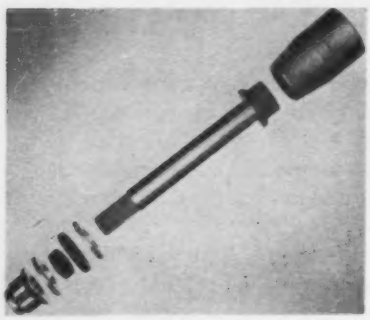
Two-Way Relieving Fixture Has Range of Applications

Hybco two-way relieving fixture is available with Model 1900 grinding machine or separately for use on any tool and cutter grinder. Fixture can be used or grinding radial relief, axial relief, any combination of radial and axial relief, and plain circle grinding. It can be furnished with swivel index base, rectangular base, or extended base with outboard bearing and tailstock, and can be motorized or hand-operated.

Setup is quickly accomplished by using dial indicators to preset the amount of relief required. The intersection of diameters and shoulders is not undercut. Cams mounted on the fixture spindle are easily and quickly changed and can be reversed for LH tools.

Henry P Boggis Co, 706 East 163rd St, Cleveland 10, Ohio

MORE DATA? Circle 73, inside back cover



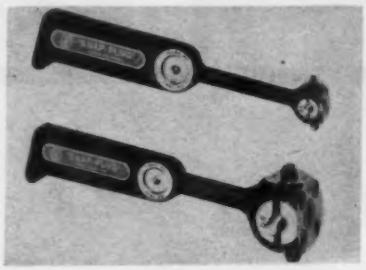
300,000-psi Bolts Developed by SPS

Tension and shear bolts, believed to be the first standard structural parts rated at 300,000-psi tensile strength, are made of a new vacuum-melted alloy called Vascojet-M-A, specially developed by Vanadium-Alloys Steel Co. Double shear strength is 180,000 psi minimum; elongation 7.0% minimum; endurance limit 120,000 psi (typical); fatigue life 65,000 cycles average; tensile strength/density ratio 1,100,000 minimum.

SPS is now producing both tension and shear bolt versions; tension bolts are available in diameter sizes No. 10 through ⅞ in., and shear bolts in sizes No. 10 through ⅝ in. A complete fastening system has been developed for both. These so-called room temperature versions are rated for use at temperatures up to 550 F. An elevated temperature series for use to 900 F is expected shortly.

Standard Pressed Steel Co, Jenkintown 44, Pa

MORE DATA? Circle 74, inside back cover

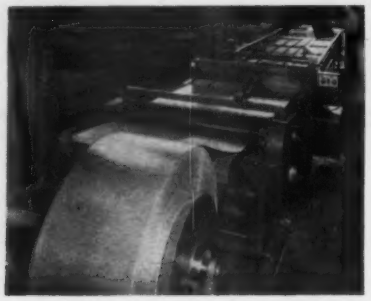


Adjustable Internal Plug Gage Furnished in Range of 1 — 2 in.

Both go and no-go can be checked at one insertion of the Snap-Plug gage into the workpiece. Simple movement of the wrist upward denotes whether the part is in size or oversize. Design eliminates need for many individual cylindrical plug gages. Conditions such as taper, bell mouth, and out-of-roundness can be readily detected. Gage pins are interchangeable and replaceable carbide tipped pins are available at a nominal cost. Complete kit contains handle, 16 gage pins, micrometer centralizing gage, adjustment wrench, and setting and operating instructions.

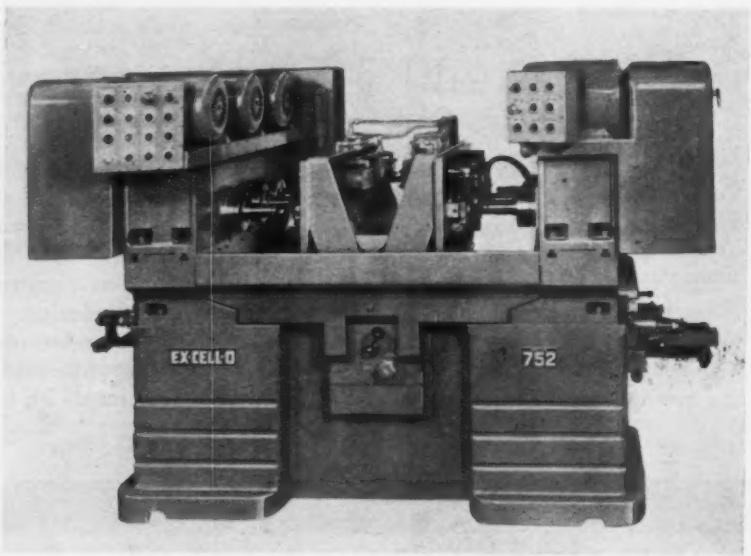
Southern Gage Co, Erin, Tenn

MORE DATA? Circle 75, inside back cover



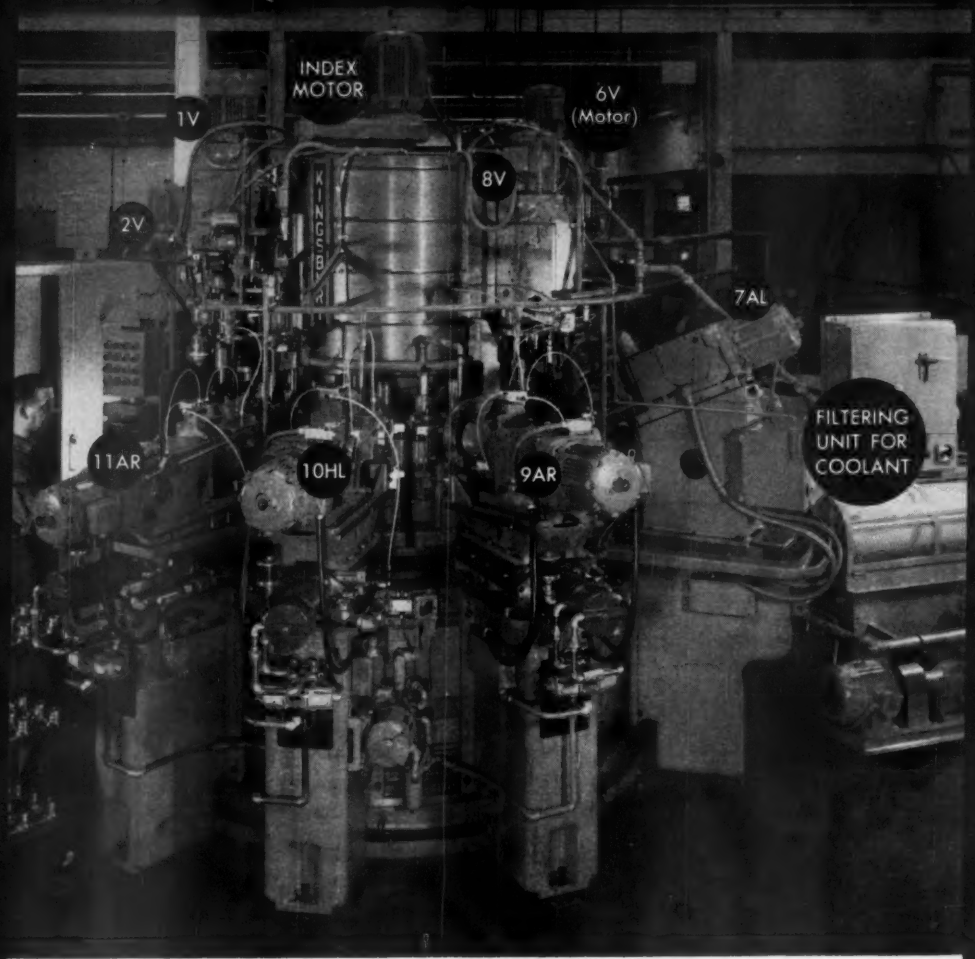
ROLLER LEVEL and cut-to-length line handles material up to either 48 or 60 in. wide, and sheet lengths from 12 to 144 in. Equipment is available for sheet lengths up to 240 in. Line is priced at under $15,000—*Huron Inc, 8348 Vine St, Cincinnati 16, Ohio*

MORE DATA? Circle 76, inside back cover



DOUBLE END PRECISION BORING MACHINE semifinish-bores and chamfers both sides of crank bearing holes in connecting rods at the rate of 600 parts an hour. Three rods are loaded at each end of a double end fixture and after the sequence is started by pushbutton the table rapids to the left to machine three rods, then back to the right for the other three—*Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich*

MORE DATA? Circle 77, inside back cover



12 OPERATIONS ON GOVERNOR BODY

1V Vertical
Step drill valve hole through

2V Vertical
Mill face 7200 rpm fine finish

3H Horizontal hidden
Rough bore large hole

4AL Angular left, hidden
Drill angular oil hole

5H Horizontal, hidden
Drill flash in 4 holes

6V Vertical
Step gun ream part of valve hole

7 HR Horizontal right, hidden
Drill angular oil hole

7 AL Angular left
Drill angular oil hole

8V Vertical
Step gun ream part of valve hole

9AR Angular right
Mill first oil pocket

10HL Horizontal left
Mill second oil pocket

11AR Angular right
Mill third oil pocket

Kingsbury machine produces fine finish at high rate, performs variety of operations

Easy change-over for work on similar part

In one chucking of the work twelve units on this Kingsbury perform all of the operations shown. With a 19-second time cycle for the operations and indexing, the gross production rate is 190 parts per hour.

SOME NOTEWORTHY FEATURES

Mill face. A motorized spindle produces a fine finish by running at high speed and then retracting from the work on the return stroke.

Mill oil pockets. Airdraulic slides position oscillating heads that feed the cutters sideways inside the hole.

Drill angular oil holes. Each unit is at an angle to the radial center line through its station. Two units are mounted on angular risers.

Five-step valve hole. Two units step gun ream with high speeds and fine feeds using filtered coolant under pressure.

With a few changes this machine also operates on a similar part. A seven spindle auxiliary head can be mounted in two different positions to drill four holes in one part or three in the other.

WE BUILD SIMPLE MACHINES TOO

If you do drilling type operations in high production — simple or complex — we want to talk business. Our good basic design and accurate rugged construction pay off for you in minimum rejects and downtime and you get years of dependable production. May we make a proposal? Kingsbury Machine Tool Corp., Keene, New Hampshire.

KINGSBURY MULTI-UNIT AUTOMATICS

CIRCLE 335 READER SERVICE CARD

WEIGH ITS TECHNICAL VAL TO PRODUCTIO AND

YOU'LL SEE WHY THIS

IS METALWORKIN MOST POWERF SELLING TOOL

UE
N MEN

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UL

Three out of five metalworking machines in the country today are over-age. The U.S. has dropped to fourth place (after Russia, West Germany and Red China) as a producer of machine tools.

What are we doing about it?

For one thing, the government promises to step in with new tax policies that will help industry to invest in new tools to narrow "the machine gap". For another, technology is moving fast . . . with new methods, new techniques for making products better, faster, cheaper.

This is where American Machinist/Metalworking Manufacturing fits in. It has led the crusade for tax policies that will help business keep its plant up to date. And more importantly, manufacturing men in plants making everything from watch bands to airframes turn constantly to AM/MM for news and information on the latest developments and techniques that will help produce more at a profit.

Because manufacturing men must keep on top of new developments in metalworking, AM/MM is a direct sales channel to this ever-vital market. More than 45,000 metalworking manufacturing men read it twice a month.

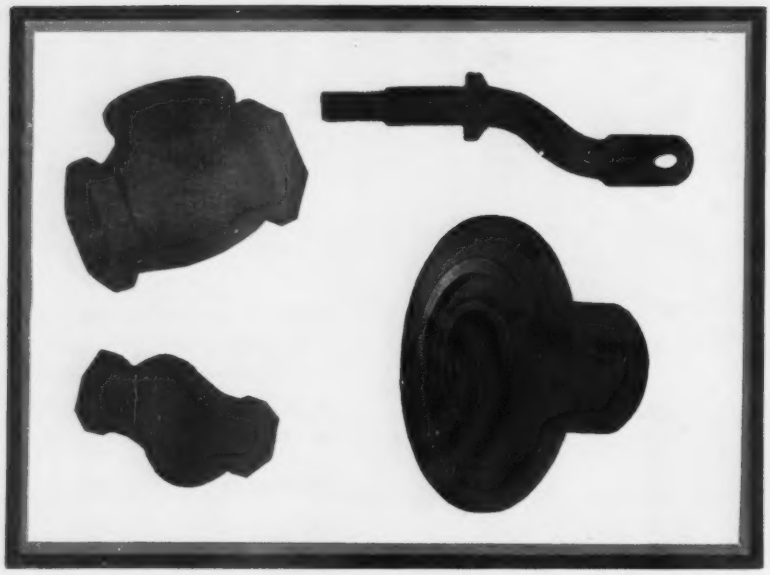
You don't have to look far beyond this fact to see why so many advertisers find this magazine metalworking's most powerful selling tool.

In metalworking—men who matter read...

American Machinist / Metalworking Manufacturing

A McGraw-Hill Publication, 330 West 42nd Street, New York 36, N.Y.

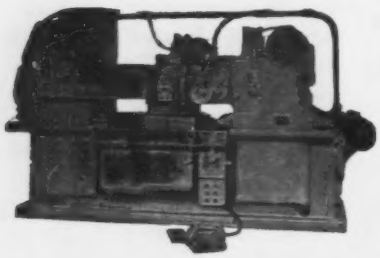
For up-to-date facts and figures on metalworking, ask your AM/MM district manager for a copy of the Market Guide for Sales Executives.



PARTS LIKE THESE and MANY OTHERS ARE BEING PRODUCED

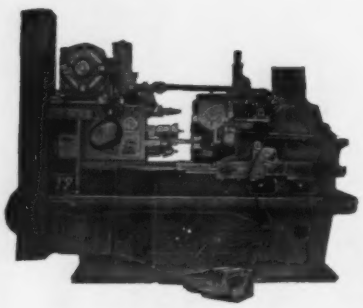
with speed, convenience and economy...

on GOSS & DeLEEUW AUTOMATIC CHUCKERS



THE "ONE-TWO-THREE" 7 - SPINDLE TOOL ROTATING CHUCKING MACHINE can complete in one operation as many as three ends of valve bodies, plumbing fittings, etc. eliminating secondary operations.

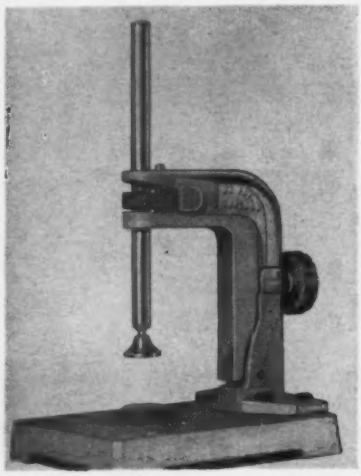
4-SPINDLE TOOL ROTATING CHUCKING MACHINES available in three sizes, combine various turning, boring, facing, threading, multiple drilling and tapping operations on a wide range of single-ended parts.



Send sampels of your work for time estimates. Ask for illustrated literature.

GOSS and DELEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

GOSS & DELEEUW



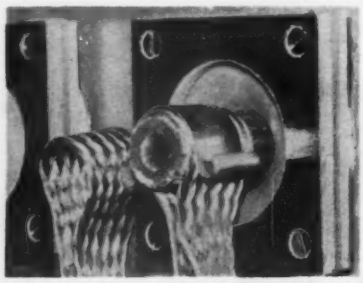
Fast Acting Holding Device Clamps Rounds, Flats, Irregular Shapes

Rounds, flats or a combination of rounds and flats can be held for such operations as spot welding, inspection or assembly with the United assembly fixture.

This holding device is a fingertip-control bench-type fixture with a reversible steel base plate, one side of which is flat, the other having a v-notch. Two threadless spindles are furnished, one has a free-acting anvil head and the other a v-end for holding rounds and irregular shapes. Maximum jaw opening of the tool is 4⅛ in. and maximum jaw depth is 2-11/16.

United Associates, 1605 N Hercules Ave, Clearwater, Fla

MORE DATA? Circle 93, inside back cover



Seals For Furnaces Eliminate Box-Type Element Enclosures

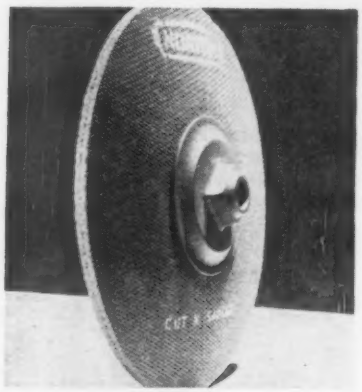
Flexible gaskets that fit tightly around the ends of heating elements are designed to replace the box-type enclosures that are ordinarily used for terminal seals. The seals allow electrical connections to be located in open air so that they are not subject to high temperatures, and operation of the furnace is simpler because there are no temminal boxes to

be purged. Inspection of terminal ends is eased and in addition furnace temperature is more uniform because there are no convection currents between the heating elements.

One end of the new seal housing is mounted over the opening in the furnace shell with a flange held in place by screws. A gasket between the flange and the shell makes this joint leakproof and restricts heat transfer from the housing to the shell. The other end of the housing has a flange and a seal consisting of one or more flexible gaskets is mounted on this flange to close over the end of the seal housing. The terminal portion of the heating element passes through a snug fitting aperture in the flexible gasket. Further leakproofing is accomplished by using a clamping ring and screws to hold the flexible gasket on its flange.

Hevi-Duty Electric Co, 304 Hart St, Watertoen Wisc

MORE DATA? Circle 94, inside back cover



Weld-Grinding Wheel Combines Saucer Shape, Throwaway Mount

Reinforced grinding wheel for weld grinding and light snagging combines the advantages of a saucer-shaped wheel with the convenience of a throw-away mount.

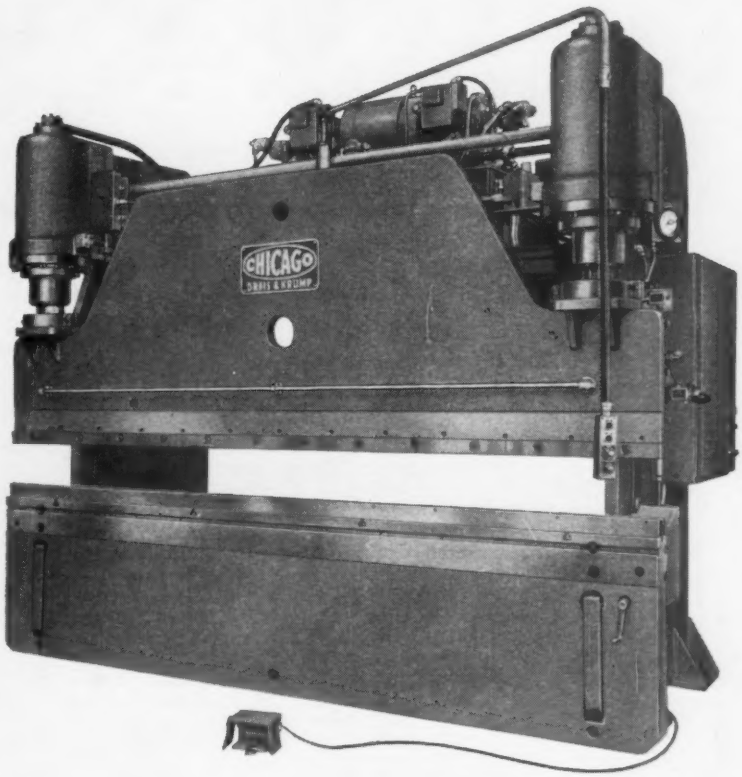
The new wheels are available in 7 and 9 in. sizes to fit standard threaded spindles on portable grinding equipment. Permanently attached mount permits the wheel to be installed on the grinder in seconds. The saucer shape allows an operator to hold the wheel at a closer angle to the work, thereby giving greater control and reducing operator fatigue.

Price of the new wheel with mount is the same as for the company's conventional reinforced wheels for the same operation.

Norton Co. Worcester 6, Mass

MORE DATA? Circle 95, inside back cover

THE OUTSTANDING
Achievement
IN HYDRAULIC PRESS BRAKES



NEW CHICAGO *Hydraulic* PRESS BRAKES
Capacities 100 to 2000 Tons

proved exclusive design features

- Long-life Oilgear variable delivery pumps
- CHICAGO simplified hydraulic circuit with ultrafine electronic sensing for unmatched ram level control
- *Infinitely* variable ram speeds within the specification limits—controls in swivel pendant or in panel
- *Zero-positioning* for maximum operator convenience
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Complete performance facts upon request 1202

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Hand and Power Bending Brakes
Special Metal-Forming Machines

CHICAGO DREIS & KRUMP

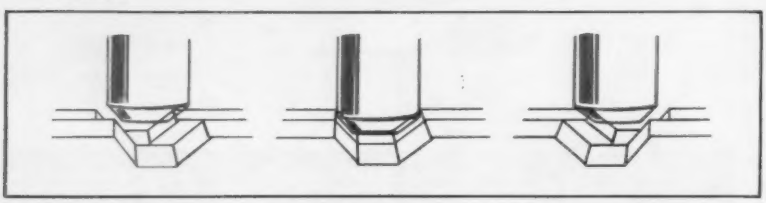
DREIS & KRUMP MANUFACTURING CO.
7434 S. Loomis Blvd., Chicago 36, Illinois

Patents Pending

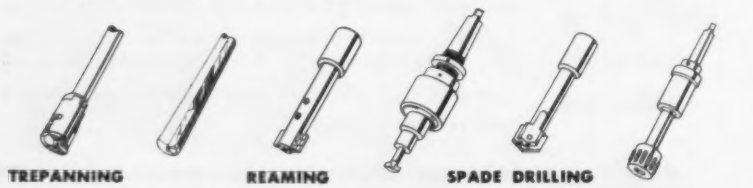
drastically reduces notch regrinding

MADISON'S DOUBLIFE® REAMER now has another new money saving feature — the Scotch Notch which is explained below. Thrifty tool buyers who are already taking advantage of the bonus metal removing capacity of Doublife will receive an additional dividend on their tooling investment with the time-saving feature of Scotch Notch. This new notch design saves up to 85%, and in one case 100%, of the notch regrinding formerly necessary when resharpening Madison or "Madison-type" reamers.

Thrifty buyers also carefully consider the "value added" benefits of service, delivery, engineering assistance, research, and dependable local representation included in the purchase price of a Madison tool. Lack of these important fringe benefits often makes a seeming bargain more expensive in the long run. Your local Madison representative can give you the whole story on our complete services. Also get the "hole" story on our hole-making, hole finishing tools.



This is how the standard reamer notches will look from now on. Don't try to line them up when you start using a new tool. You don't have to. They fit the standard bar, same as before. As you re-sharpen and expand the tool, the notches will begin to line up anyway. Then they will become offset in the opposite direction. You will find that notch regrinding is seldom necessary and on one size not at all.



TREPANNING GUN DRILLING REAMING RECESSING SPADE DRILLING ROLLER BURNISHING

Originators and sole manufacturers of time-tested Madison tools.

MADISON Industries, Inc.

P. O. BOX 6307, PROVIDENCE, RHODE ISLAND

Centerless Grinder Part Gage Detects Out-of Tolerance Work

Automatic gage for centerless grinders has a limit signalling comparator and a gaging fixture with twin air jets on a V block. The V block is mounted to the end of the centerless grinder rest blade and as parts leaving the grinder enter the fixture and pass between the opposing air jets the increase or reduction of the air flow caused by diameter variations is translated into a signal that actuates a meter and signal light. The large warning light on top of the unit and upper and lower limit lights flash to warn the operator that parts are out of tolerance. Parts in tolerance are signalled by a green light.

Radio Corporation of America, Industrial and Automation Div, 12605 Arnold Ave, Detroit 39, Mich

MORE DATA? Circle 96, inside back cover

ELECTRONIC MICROMETER, new Carson-Dice Model HDR, (AM-Dec 3 '56, p188), displays measurements on a four-digit counter reading to 20 millionths of an inch. Measurements on conducting parts can be taken at zero pressure; for non-conducting materials, a special tip can be slipped on the micrometer spindle—*J W Dice Co, Englewood, NJ*

MORE DATA? Circle 97, inside back cover

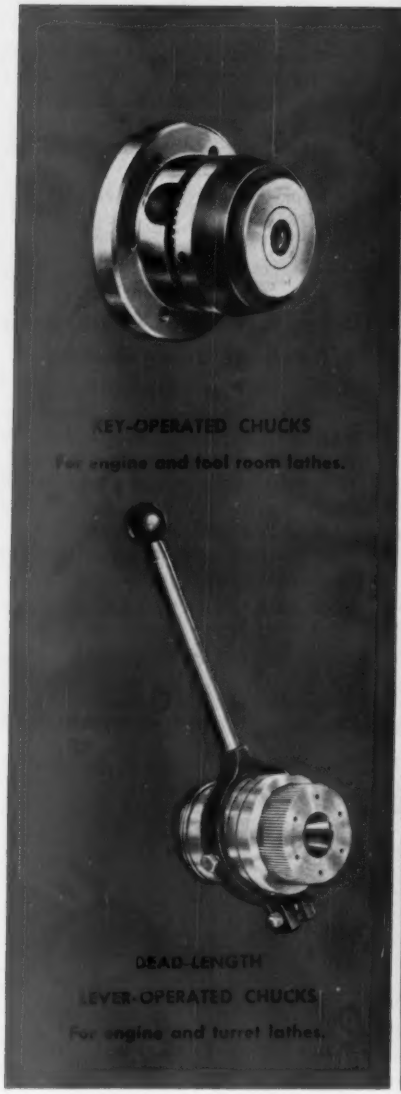


TABLE MOUNTING CHUCKS
For mills, drills, gear generators, dividing heads.
TOOL HOLDERS
For lathes, drills, mills, grinders, boring machines.

SYSTEM

WHERE 10 WILL GIVE YOU 100

Burnerd's new Multisize Collet System—in which each collet has a stepless gripping range of 1/8"—actually replaces conventional collets in the ratio of one for ten! Here's what you get:

- ACCURACY to within .0005" at collet nose—unobtainable with any other collet.
- ALL STEEL CONSTRUCTION—assures unmatched accuracy and gripping power throughout long, trouble-free service life.
- GRIPPING VERSATILITY which is infinitely variable—from maximum for heaviest torque loads and end thrusts to minimum for soft and fragile materials. Precision ground blades, set radially in tapered body, grip work along their entire length.

Burnerd key-operated collet chucks, dead-length lever collet chucks, table mounting chucks, and tool holders—combined with Multisize collets—produce a "shop-wide" system that is highly accurate, efficient, and economical. Get the full story on how "ten will give you a hundred!" Write for detailed literature today.

367

BURNERD COLLETS

CLAUSING DIVISION
ATLAS PRESS COMPANY
11-202 N. PITCHER ST. • KALAMAZOO, MICH.

EVER SIT ON A CONCRETE BENCH

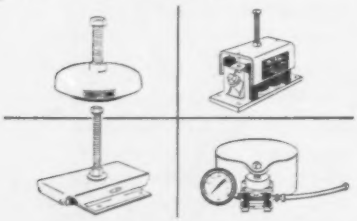
WITHOUT A CUSHION?

The longer you sat on it . . . the more you wished you had a cushion, didn't you? And remember how you felt every little vibration from those passing trucks?

Precision manufacturing equipment feels vibration too, but it can't get up and move away very easily — particularly when it's lagged down to a concrete foundation! Machine tools simply show their discomfort by higher reject rates or continuous maintenance problems.

What's the answer?..SERVA-LEVL® Mounts . . . a new concept that floats precision machinery on columns of air! Even ultra-precision, numerically controlled machines no longer require special, *costly* foundations. And, SERVA-LEVL Mounts *automatically* keep your machines *absolutely level* . . . as precise as 50 millionths of an inch per foot under the shifting load conditions of a long-bedded lathe.

If your machine tools are bothered by vibration, or if you want layout flexibility, no-shim leveling, reduced maintenance, and cost reduction . . . write for your copy of Bulletin 60-04B, "Practical Considerations When Installing Machinery."

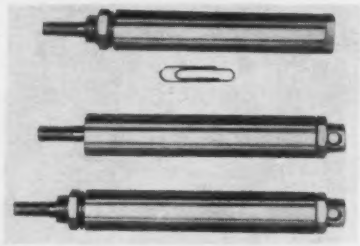


BARRY CONTROLS

SHOCK • VIBRATION • MACHINE EFFICIENCY

Division of Barry Wright Corporation

700 PLEASANT ST., WATERTOWN, MASS.
1400 FLOWER ST., GLENDALE, CALIF.



9/16-in.-Bore Cylinder Designed For 250-psi Air, 2000-Hydraulic

Heavy-duty fine-pitch screw-together miniature double-acting and spring return air-hydraulic cylinder is introduced for jibs, fixtures and automation equipment. Designed for working ranges up to 250-psi air and up to 2000-psi hydraulic, the unit is supplied in stud, clevis, and universal mounting styles. Double-acting cylinders are furnished in six strokes, 1 through 6 in; single-acting (spring return) in 1, 2, and 3-in. strokes. Rod extension is ¾ in., threaded ¼ 28 x ½ in. Power factor is 0.24 on push stroke and 0.20 on pull.

Clippard Instrument Laboratory Inc, 7390 Colerain Rd, Cincinnati 39, Ohio

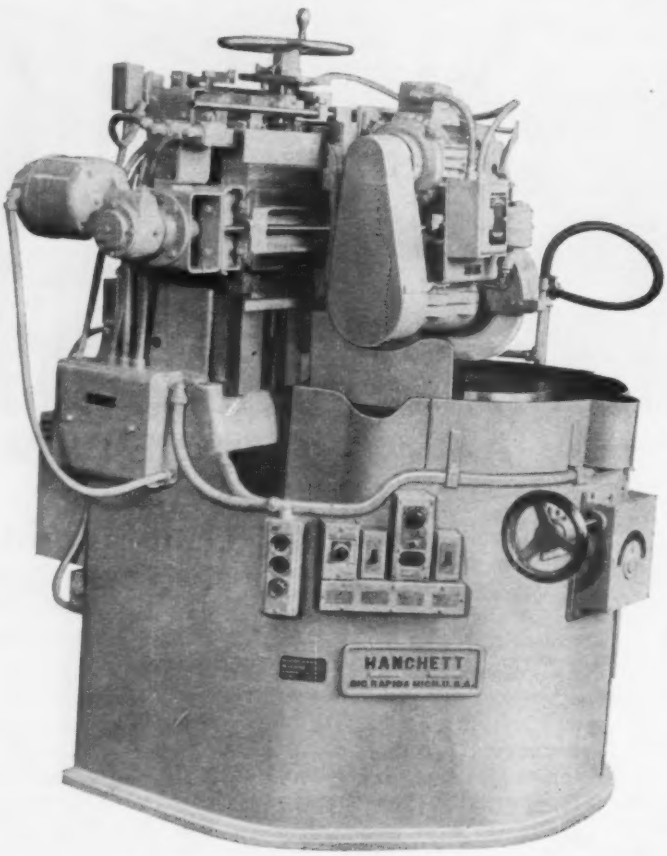
MORE DATA? Circle 98, inside back cover

Milling Feed Added To Ultra-sonic N/C Package Milling Machine

Milling feeds have been added to the Ultra-Sonic numerically controlled milling machines (*AM/MM* July 10 '61 p126) with no change in price. With this addition an operator can finish work with a single tape for drilling, boring and milling.

Ultra-Sonic Precision Co, Inc, 235 Fourth Ave, Mt Vernon, NY

MORE DATA? Circle 99, inside back cover



SLITTER KNIFE GRINDER, the SK-24 High Power, employs a 12-in. wheel mounted on a precision Pope spindle. Motor is fully balanced, 3 hp, and all supporting members are made heavier to give adequate support to the larger grinding head assembly. Downfeed, crossfeed, and oscillation of the grinding head are each equipped with motor drive. Controls are fully automatic—*Hanchett Mfg Co, Big Rapids, Mich*

MORE DATA? Circle 100, inside back cover

Never underestimate the cost-saving advantages of LAMINUM®

We address this statement to design, tool, production, inspection and assembly engineers . . .

Holding to extremely close tolerances is a costly procedure. You know that. What you may not know is that frequently you can ease up on tolerances without sacrificing a single thousandth of your precise assembly objectives.

How? By using LAMINUM!

LAMINUM is the registered trade name for laminated shims whose layers are completely surface-bonded to look and act like solid metal. The layers are easily p-e-e-l-e-d to bring the shims to any desired thickness—for a thousandth fit right at assembly.

With LAMINUM in the specs, machining operations become less critical, faster and less costly. Inspection is simpler and less costly. The savings carry over to the assembly line, too. No stand-by equipment. No machining. No grinding. No counting, stacking or miking. And no dirt between layers—ever!

Get the facts about cost-saving LAMINUM, and the custom-stamping service that goes with it. They're all illustrated and described in our Shim Design Folder No. 4. Write for it.

THE LAMINATED SHIM COMPANY, INC.

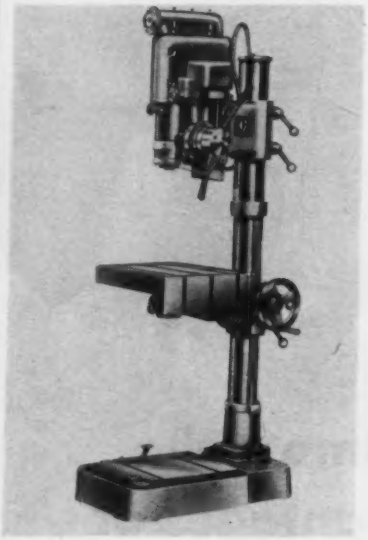
West Coast Sales and Service
600 SIXTEENTH ST., OAKLAND, CALIF.

Home Office and Plant
3111 UNION STREET, GLENBROOK, CONN.

IN BRASS MILD STEEL STAINLESS ALUMINUM...WITH LAMINATIONS .002" OR .003"
NOW ALSO IN TITANIUM WITH LAMINATIONS .003"

STAINLESS
MOLYBDENUM
TITANIUM
BERYLLIUM
COBALT
COLUMBIUM
NICKEL
TANTALUM
TOOL STEEL
HIGH SPEED

TAP MAGIC
A CUTTING FLUID
FOR
• Improved Machinability
• Improved Surface Finish
• Improved Tool Life
THE STECO CORPORATION
BOX 2135 • LITTLE ROCK, ARKANSAS



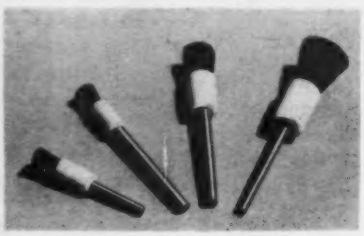
1¼-in.-Capacity Drilling Unit Has Speeds to 3240 rpm

Major features of the British-made York high-speed geared-head pillar drilling machine include a dial speed selector and a motor integrated in the head for direct all geared drive. Unit has a sliding head with safety ratchet on the head elevation, adjustable Timken bearings in the No. 3 Morse taper spindle. Three power feeds (optional) can be selected by dial control with positive depth stop and overtravel protection.

Drilling capacities are 1¼ in. in cast iron and 1 in. in steel. Drilling depth is 4¼ in., and the swing measures 23½ in. Two models are available, one with 6 spindle speeds with a range of from 115 to 1690 rpm, the other with 12 speeds from 115 to 3240 rpm. Machine is priced from $560.

Dist by Bentley Industrial Corp, 21-19 46th Ave, Long Island City 1, NY

MORE DATA? Circle 101, inside back cover

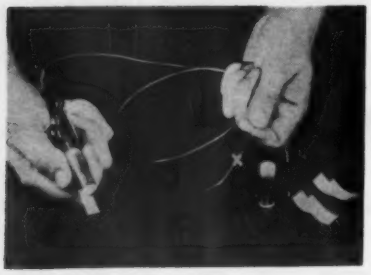


Miniature End Brushes Equipped With Nylon Ferrules

Scratch-Gard series of nylon head miniature end brushes are reported to eliminate scratching when polishing delicate surfaces such as molds used by injection mold makers. They are available in 3/16, ¼, and 5/16-in. ID ferrule sizes and in stem diameter sizes 3/32 and ⅛ in. Wide choice of fill material is available, depending on brush-polishing application. The material is firmly imbedded in the white nylon ferrule and is capable of withstanding rpm ratings in excess of 20,000.

Weiler Brush Co, 2100 Lake Front Lane, Cresco, Pa

MORE DATA? Circle 102, inside back cover

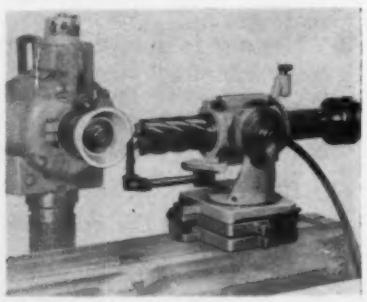


Marking Pen Conversion Kit Uses Replaceable Cartridges

Designed to replace present marking devices in less than 10 minutes this new marking pen has a replaceable cartridge ink supply and sealed capillary system that will give a clean legible record. Blotting, smearing, running, or dripping are eliminated by the pen which is part of a kit that will reportedly replace over 90 percent of the marking systems now in use. The kit consists of one stylus (4 sizes available) capillary tubing, a universal adapter, a cartridge holder and 4 plastic ink cartridges in a choice of 5 colors.

Esterbrook Pen Co, 200 Cooper St, Camden 1, NJ

MORE DATA? Circle 103, inside back cover



IMPROVED AIR-CUSHIONED SPINDLE BEARING is now standard equipment for the Rocheleau universal cutter grinding fixture Unit 1-B. Company's Unit-1 or 1-A, currently in use, can be converted to air-cushion operation with this spindle bearing—*Rocheleau Tool & Die Co, Leominster, Mass*

MORE DATA? Circle 104, inside back cover

HOW TO REACH GREATER DISC GRINDING QUALITY

...take the BESLY 3G ROUTE

Unity is a basic reason for grinding superiority on the Besly3G Route. *All* your disc grinding problems and requirements are studied by one experienced source, Besly. *All* are met—no matter how stringent or diverse—by the same source. And it's all available through one man, your Besly grinding specialist—your Besly G³. Here's how he makes it work:

G¹ Abrasive performance is studied on the job. Quality, abrasive cutting action and efficiency are watched, closely. Besly abrasive recommendations that result are right because they are designed for the job.

G² You use the broad knowledge and experience of your Besly grinding specialist to the best advantage . . . to make your grinding processes a more profitable art.

G³ Your grinding requirements determine the Besly disc grinder we recommend. The grinder that does the job faster . . . better! The one that returns more for every tool dollar you invest.

REQUEST THIS BOOKLET! Tells how you can achieve greater grinding quality every time. Write direct today!

BESLY®

BESLY-WELLES CORPORATION

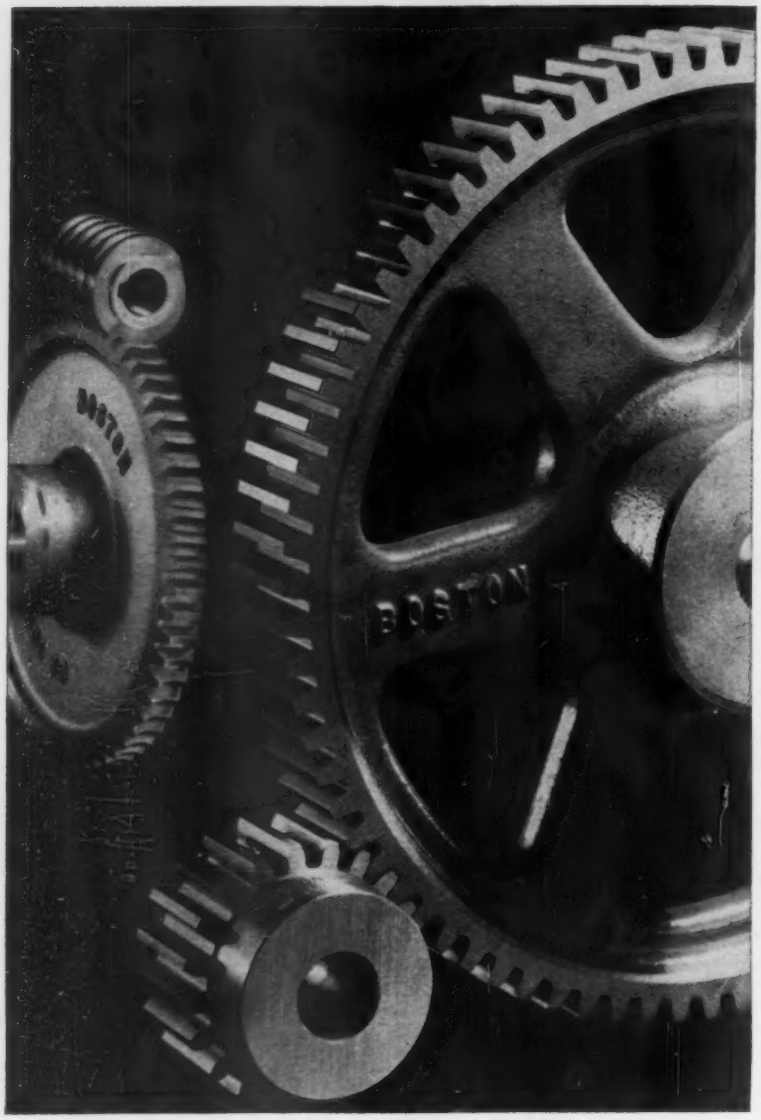
120 Dearborn Avenue • South Beloit, Illinois

Grinders and Abrasives • Taps • X-Press® Taps
Drills • Reamers • End Mills • Tool Bits • Gages
Carbide Tipped Tools • Blanks • Inserts • Holders

ASK YOUR BESLY G³ FOR AN ABRASIVES PERFORMANCE TEST—1—Tell him the material to be ground. 2—Tell him the amount of stock that must be removed. 3—Tell him the finish required. 4—Tell him the area in contact with the abrasive. 5—Tell him the spindle speed. He'll do the rest.

BOSTON Gear® QUALITY

14½° stock gears 20°



Largest selection – off the shelf.

1781 types and sizes 14½° P.A. – 48 to 3 pitch.

782 types and sizes 20° P.A. – 120 to 4 pitch.

Spur, bevel, miter, worm, helical, spiral miter.

Brass, steel, iron, nonmetallic. See Catalog 57.

IN STOCK at your nearby DISTRIBUTOR

BOSTON Gear®

© Boston Gear Works, 1961
Quincy 71, Mass.

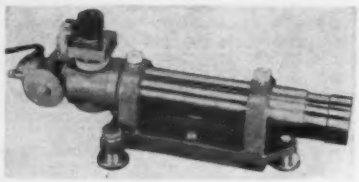
Line of Hole Saws Offered In Diameters From 9/16 to 6 in.

Nuweld Shatterproof hole saws cut holes in steel, cast iron, stainless, aluminum, copper, brass, wood, plastics, and other machinable materials up to 1⅛ in. thick.

Features include HSS cutting edges electrically welded to tough alloy-steel backs; accurate rolling to diameter; silver soldered seams; permanent bonding to resilient steel caps; shoulderless design for deep cuts through stacked materials; knockout slots for easy removal of cores.

Heller Tool Co, Newcomerstown, Ohio

MORE DATA? Circle 105, inside back cover



Auto-Collimator Measures Two Planes Simultaneously

Universal Microptic auto-collimator TA-51 permits direct reading of horizontal and vertical planes simultaneously to 0.1 sec over a range of 19 min of arc. Illuminator and micrometer units are interchangeable to assemble for straight or right-angle viewing.

New, larger objective lens produces improved definition and working distances to 100 ft. Model TA-50 auto-collimator has the same features except that it views two planes individually, without rotating its tube.

Engis Equipment Co, Div of Engrg & Scientific Instrumentation, 431 S Dearborn St, Chicago 5, Ill

MORE DATA? Circle 106, inside back cover

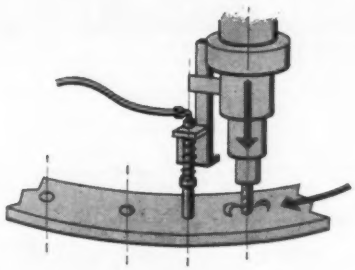
How 1 pneumatic recorder at GE led to 14 more

The first one did such a good job that General Electric's Evendale, Ohio, plant bought an additional 14 Sheffield pneumatic recorders, for application to automatic indexing jig borers.

An adjustable bracket on the quill holds a floating air spindle. After each hole is bored, the spindle enters the hole, automatically records the bore size. If the hole is within limits, the next hole is bored. If the diameter is not within specifications, the operator is warned by both lights and a buzzer.

The Sheffield Pneumatic Recorders proved so reliable that dimensions recorded at the machine have—in many cases—eliminated the need for subsequent inspections.

Write for Bulletin PREC.-212.



The SHEFFIELD Corporation Dayton 1, Ohio

A subsidiary of The Bendix Corporation

inspection Gages, Dimensional Control Instruments, Machine Controls, Automatic Gaging & Assembly Systems, Measuray® X-Ray Thickness Measuring, Crushtrue® & Multiform® Grinders, Cavitron® Ultrasonic Machine Tools, Press-Pacer® Transfer Units, Large Dies, Tooling, Contract Manufacturing.

HAMILTON Tapping MACHINE

SUPER SENSITIVE

2992

Capacity — 000-120 to 10-24

In the field of small hole, precision tapping the HAMILTON Super Sensitive Tapping MACHINE stands alone. It is smooth, silent, precise, and sturdy. Spindle returns to neutral position and stops rotation instantly and automatically when pressure on the feed lever is released. To learn what this means to you,

write for our free Bulletin No. 2992.

THE HAMILTON TOOL COMPANY

830 SOUTH NINTH STREET **HAMILTON, OHIO**

REPRESENTED IN CANADA BY

Sykes Tool Corporation, Ltd., Georgetown, Ontario.

CIRCLE 348 READER SERVICE CARD

THE PRODUCTION MAN'S GUIDE TO LEADED STEELS

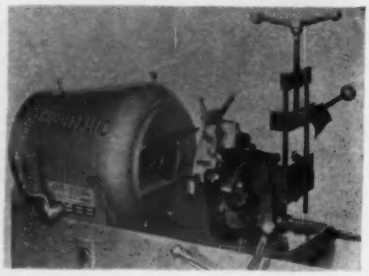
What are they? When should they be used? What grades are available. What are their advantages? How can they save you money?

All answered in this 8-page report available at 25¢ per copy from

Reader Service Department

American Machinist/Metalworking Manufacturing

330 West 42nd Street, New York 36, N. Y.

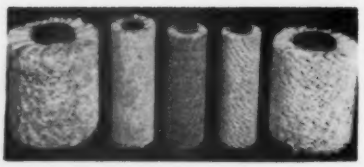


Collins Machinery Offers Automatic Pipe Threader

New Thread-O-Matic 44 threading and cutting machines have several major advantages according to the manufacturer. The double automatic chuck is totaly enclosed, and an extensive assortment of mono, dual or universal scroll adjustment die heads are offered all with built in automatic oil flow. Mono die heads that may be ordered with attached reamers so that threading and reaming are done at the same time are a feature as are interchangeability of position of cutter and reamer assemblies. The range of the Thread-O-Matic 44 is ⅜ to 4 in. in pipe and conduit, and ⅝ to 3 in. in bolt.

Collins Machinery Corp, Monterey Park, California

MORE DATA? Circle 107, inside back cover



Buffing Wheel Offered In New Design

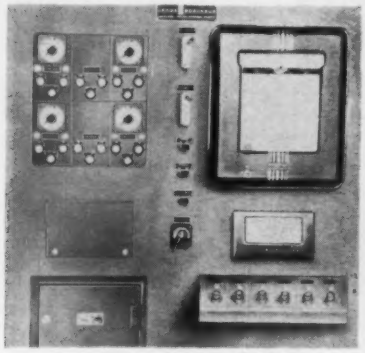
The Churchill Spyrl-Roll buff is made from one continuous strip of buffing element or material, which may be either the company's finger type or the standard bias type, either cloth or sisal, furnished in soft, medium, and hard densities.

Continuous spiral construction provides the advantages of performing a double cutting action. Buffing element rotated against the work provides one cutting action while its sideways movement provides the second cutting action. It is provided in cartridge form ready for immediate use in various widths up to 45 in. and in 41 to 20-in. diameters. Keyways are furnished for mounting on the shaft to prevent slipping.

Geo R Churchill Co, 1 Churchill Rd, Hingham, Mass

MORE DATA? Circle 108, inside back cover

NEW SHOP EQUIPMENT



Leeds & Northrup System Monitors And Controls Gas Compounds

Exhibited at the Detroit Metal Show, this infrared multi-control system for heat treating furnaces and generators combines the measurement and control of any one of three gas compounds—CO, CO_2, or CH_4. Probes in the system that can be located at any point in the heat treat continuously bring fresh gas samples to the analyser for measurement and control. Standard equipment will monitor from 2 to 6 points.

The system is a completely assembled package with instruments, analyser cabinet, and all necessary hardware mounted and wired. Calibration can be checked in three minutes against a known reference standard.

Leeds & Northrup, 4934 Stenton Ave, Philadelphia 44, Pa

MORE DATA? Circle 109, inside back cover

NEW LINE OF MACHINES designated Series 40, 50, and 60, use the roll forming dies shown above to form shapes from light gage metals. Series 40 are designed primarily for small shapes such as awning components, weatherstripping, and glazing bead. The Series 50 are for structural members of moderate size and the Series 60 for roof panels and deep structural components.

Met-L-Rol Corp, P O Box 1417, Hialeah, Florida •

MORE DATA? Circle 110, inside back cover

CIRCLE 350 READER SERVICE CARD ➤

GAGING IN TENTHS? HERE'S CERTIFIED "X" ACCURACY. OFF-SHELF DELIVERY, 3,000 SIZES!

U.S. PATENT 2,715,291

ALL SIZES .038 - .250 IN STOCK IN TENTHS! 25-GAGE TENTH SETS NOW IN DRILL-SIZES, #1-61, AND IN 64ths FROM 3/64" THRU 1"

$1.58 per gage, in 25-gage sets under .3750"

$39.40 25-gage sets under .3750"

DELTRONIC

FREE! SPECIAL INTRODUCTORY OFFER! FREE SAMPLE ½" PLUG GAUGE! WRITE TODAY TO DELTRONIC!

CLASS "X" - PLUS .000,040" - MINUS .000,000" • PRECISION LAPPED APPROXIMATELY 1 MICROINCH FINISH • LENGTH - 2¼", 2½", 3", 3½"

BLUE CHIP CUSTOMERS

AERO-JET GENERAL • CALIF. INSTITUTE OF TECHNOLOGY, JET PROPULSION LAB • CONVAIR DOUGLAS AIRCRAFT • NORDENKETAY • THOMPSON-RAMO-WOOLRIDGE • SUMMERS GYROSCOPE • RAYTHEON • GENERAL ELECTRIC • GRAFLEX • ACF INDUSTRIES • MARQUARDT AIRCRAFT • PERKIN-ELMER HAMILTON STANDARD • WESTINGHOUSE • CADILLAC MOTOR CAR CO. • FORD AERONUTRONICS • IBM • RCA • PHILCO

Certification of Accuracy

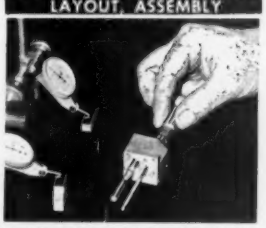
DELTRONIC CORPORATION unconditionally guarantees each gage herein to be within a size tolerance of plus .000,040", minus .000,00"; surface finish approximately one microinch; both ends concentric to one another. All Master Gages in our plant are calibrated semiannually or oftener, with standards traceable to the National Bureau of Standards, Washington, D. C.

Inspected by 235

RELIABILITY is assured through continuous checking and surveillance of all Deltronic production and inspection facilities by MetroLonics, an Independent Metrology Laboratory, with standards uninterruptedly and directly traceable to the National Bureau of Standards, Washington, D. C. To maintain the most exacting requirements of precision measurement, all gaging standards used in manufacturing of Deltronic gages are calibrated and certified quarterly . . . MetroLonics also completely checks samples of each and every Deltronic production run.

INSPECTION Electronic gaging equipment, accurate to ten millionths or better, is used for all measurement. Roundness is checked on a Talyrond with spindle runout guaranteed to one millionth accuracy. A polar chart showing roundness of a production run Deltronic gage is reproduced at left. Final lapping, grinding, and inspection performed in Deltronic's plant is in temperature controlled rooms, maintained within standard 68°, plus or minus one tenth of 1°.

IDEAL FOR HOLE LOCATION LAYOUT, ASSEMBLY



Manufacturer of Missile Components: "Used on measurement of precision servo devices which use highly precise gears, and whose center distances are extremely critical and must be maintained accurately. Also indispensable as assembly accessories for lining up gear boxes' bores. Tenth step gaging resulted in 30% saving on production-measurement and inspection of hole-spacing. Replaced standard plug gages and dial bore gages used formerly."

PRODUCTION SPEEDED BY TENTH STEP GAGING

Machine Tool Manufacturer: "With the .0001" steps, the operator knows at all times exactly what diameter the hole is and is able to correct his setting accurately. The short length of the Deltronic gage versus dial bore, or standard gage with handle, enables a much shorter backout. With the positive indication of size provided by the Tenth Step system, a savings of nearly one minute was effected on each part, and the gage set paid for itself on this one run."

INSPECTION SIMPLIFIED WITH VARIETY OF SIZES

Electronics Manufacturer: "Particularly desirable was the low initial cost and the availability of a wide range of sizes in tenths for immediate use, thus making rapid production, drill jig and inspection fixture checking easier. All of these factors resulted in substantially saved time and much greater product reliability than was possible prior to using the Deltronic Gaging system for this precision gaging work."

PRICES OF SETS, AND NOMINAL SIZES IN STOCK

FRACTIONAL SETS

Complete coverage of every fractional size from 3.64ths thru 1", in 1/64th" increments.

PRICE LIST - F564-A, B, C SETS

F564-A - 3/64" thru 3/8" $41.50
F564-B - 25/64" thru 5/8" $41.50
F564-C - 41/64" thru 1" $74.50

25-GAGE TENTH SETS

Nominal size, + and — 12 tenth steps. Set #TP25 consists of nominal gage with 24 additional gages. Twelve gages range upward from nominal in .0001" steps each. Twelve gages range downward from nominal in .0001" steps each.

PRICE LIST - TP25 SETS

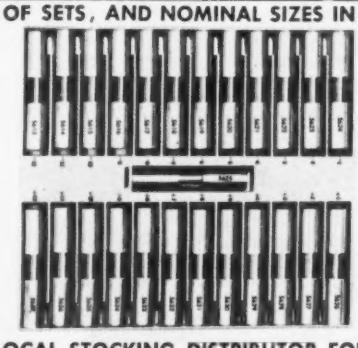
Nom. sizes .039 thru .3750 ..... $39.40
Nom. sizes .3775 thru .4230 ..... $43.80
Nom. sizes 41/64" thru 1" $52.20

"HALF-THOU-SETS"

Each set consists of a nominal size gage, plus 11 or 23 gages ranging upward from nominal gage in .0005" steps . . . Nominal size coverage from .038" to .625" scheduled for production, in nominal size increments of .005", starting at .038"

PRICE LIST HT12, HT24 SETS

Nominal sizes	HT12	HT24
.039 thru .3750	$23.90	$39.40



DRILL-SIZE SETS

Complete coverage of all number drill sizes, economically, for quick and accurate reference

PRICE LIST - D561-A, B, C, SETS

D561-A - 1 thru 20 ..... $41.00
D561-B - 21 thru 40 ..... $41.00
D561-C - 41 thru 61 ..... $43.00

9-GAGE TENTH SETS

Nominal size, + and — 1, 2, 5, 10 tenths. Set #TP9 consists of nominal gage with eight additional gages. Four gages range upward from nominal .0001", .0002", .0005", .0010". Four down from nominal, .0001", .0002", .0005", .001

PRICE LIST - TP9 SETS

Nom. sizes .039 thru .3750 ..... $19.60
Nom. sizes .3775 thru .6270 ..... $22.40
Nom. sizes 41/64" thru 1" $29.80

THOUSANDTH STEP

Each set contains one nominal gage, plus 12 gages ranging upward from nominal in .001" steps, and 12 gages ranging downward from nominal in steps of .001", total of 25 gages in each set.

PRICE LIST - THO-25 SETS

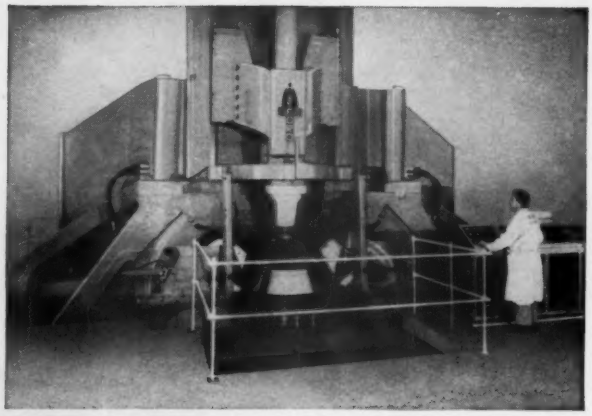
.030 thru .375 ..... $39.40
.400 thru .625 ..... $43.80

PHONE YOUR LOCAL STOCKING DISTRIBUTOR FOR FAST SERVICE

ARIZONA - Phoenix
Di Eugenio Tool AL 8-8364
CALIFORNIA - Los Angeles
Egar Tool & Supply CU 3-9213
Frey Industrial LU 8-4281
Marshall Tool AN 3-6121
Quality Control Co. HO 9-5385
Dan Richetts Co. CU 3-5642
Paul B. Slater Co. RA 3-7251
Union Industrial UP 0-6936
Victor Tool DR 8-4067
CALIFORNIA - San Diego
Quality Control Co. HOllywood 9-5385
CALIFORNIA - San Francisco
Brennan-Hamilton JU 9-2700
COLORADO - Denver
Di Eugenio Tool EAst 2-5000
CONNECTICUT - W. Hartford
Thos. E. King Co. AD 6-3522
FLORIDA - Miami
Lafayette Tool NE 4-7604
ILLINOIS - Rock Island
Ziol Supply Co. 6-6120
IOWA - Cedar Rapids
Ted Froeberg Co. 2-6547
MARYLAND - Baltimore
W. C. Chapman and Sons BR 6-5094
MASSACHUSETTS - Boston
Marlon Equipment WA 2-3848
MICHIGAN - Detroit
B-H Tool & Supply JE 6-7543
MISSOURI - Kansas City
Hansen Machinery VI 2-3558
MISSOURI - St. Louis
Helco PR 6-1787
NEW JERSEY - Caldwell
Stamco CAldwell 9-0660
NEW MEXICO - Albuquerque
Equipment Sales CH 7-3781
NEW YORK - Manlius
House of Tools HA 2-9432
NEW YORK - White Plains
Main Tool & Supply 9-0037
NEW YORK - New York City
Mausner Equipment Co. IV 1-5677
A. N. Nelson, Inc. MAin 5-3850
Morris Abrams, Inc. CAnal 6-6900
OHIO - Cleveland
U. S. Carbide Tool LA 4-2986
OKLAHOMA - Tulsa
Wm. L. Riggs Co. TE 8-1567
PENNSYLVANIA - Philadelphia
Alden Supply Co. WA 2-7910
TENNESSEE - Memphis
Branch-Merwin BR 6-6102
TEXAS - Dallas
Southwestern Precision EM 3-1721
WISCONSIN - Milwaukee
Akrolino Machines ME 4-5642

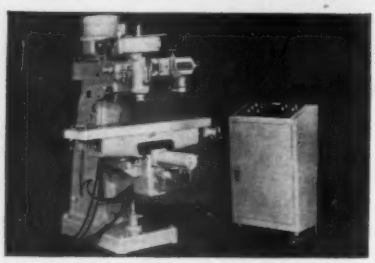
DELTRONIC CORPORATION 929 BAKER ST., COSTA MESA, CALIFORNIA

ACCEPTED ACCURATE AUTOMATIC



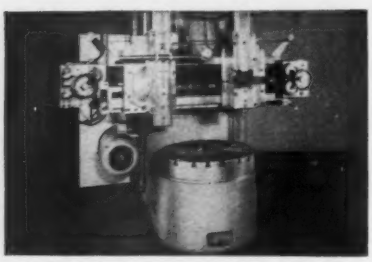
Hufford Corporation spin forge machine with *two* Honeywell 360° Tracer Control Systems plus spindle speed control.

HONEYWELL ELECTRO HYDRAULIC TRACER SYSTEMS



Gorton Vertical Milling Machine equipped with Honeywell 360° Electro Hydraulic Tracer Control System.

Frauenthal vertical contour (radome) grinder with Honeywell Electro Hydraulic Tracer Control System.



Giddings & Lewis Vertical Mill with two Honeywell 360° Electro-Hydraulic Tracer Control Systems.

Now operating on a wide variety of well-known machine tools (some of them illustrated at the left), Honeywell 180° and 360° Tracer Control systems provide fast, accurate and reliable system response for smooth application of large increments of hydraulic power.

They combine the flexibility, remote control and finesse of electronics with the power and fast actuation of hydraulics. They're far more flexible than completely hydraulic systems. These systems have been designed for ease of application. Modular construction simplifies and speeds field service.

ACCURACY—Accuracies of + .0005″ from template to part and + .0002″ from part to part have been achieved in actual use.

ADAPTABILITY—These systems are now in operation on all types of machine tools, from light duty engine lathes to huge spin forging machines. Every application is custom fitted—at production line prices.

PERFORMANCE—Each Honeywell system becomes an integral part of the machine tool. The control system can be adjusted to compensate for changes in machine performance during the life of the machine. Speed range of 300 to 1 is normal; greater rangeability is available on some applications. Tracing speed ranges up to 60″ per minute are available.

For further information on Honeywell's new machine control systems and components and their application to your specific job, contact Minneapolis-Honeywell, Machine Control Group, Dept. AM-11-61, Minneapolis 8, Minnesota. *Sales and service offices in all principal cities of the world.*

Honeywell

First in Control

Completely Tooled Assembly Units Being Built by Robodyne

US Industries' Robodyne Division, maker of the TransfeRobot (*AM/-MM*—July 24, '61, p121) is now producing dial-type assembly machines that will be supplied completely tooled with fixtures, TransfeRobots, vibratory feeders, and assembled-article removal devices.

Dial sizes will range from 24 to 54 in. in diameter, according to present plans. Extra-rugged bearings permit heavy loads of fixtures and workpieces, with minimum deflection, even if certain machining or riveting operations are performed. Accuracy of indexing is claimed to be within 0.001 in. Bed castings for the machines have circumferential T-slots for mounting heavy brackets which can be placed where desired around the periphery of the table and repositioned when required. TransfeRobots or other pieces of equipment are mounted on these brackets and vibratory feeders are stationed to supply parts and fasteners for the assembly. Robodyne also makes the feeders which have bowls with replaceable selecting means for the parts if a product change is made.

Dial is indexed at a rate compatible with the stroke requirements for the TransfeRobots. Maximum movements of the device are 2 in. up, 10 in. out, and 2 in. down. Minimum movements are 5/8 in. up, 3 in. out, and 3/8 in. down. Programming of the TransfeRobot is simple. Controls are reset to cause the device to pick a part from a chute or delivery track, move it out to a position above a fixture nest, and move down to place the piece in the nest. If desired, the mechanical hand will reach over to a fixture and extract the work at timed command.

The $2500 TransfeRobot unit consists of an arm and an actuator which can be fitted with many types of fingers and jaws and even an accessory swivel. The electronic brain of the device not only controls the jaws but also issues orders to other TransfeRobots, or to accessory machines set up around the dial.

Edwin F Shelley (left), vice president of **US Industries**, and inventor of the TransfeRobot, discusses features of the new dial-type assembly machine with **John D Goodell**, president of the **Robodyne Division**

Reliance Electric Expands Through Swiss Associate

Arrangement for production facilities in Switzerland have been made by Reliance Electric & Engineering Co of Cleveland and the company has also broadened its licensing agreements in Great Britain in a two-way effort to win a share of the growing West European market for the tools of automation.

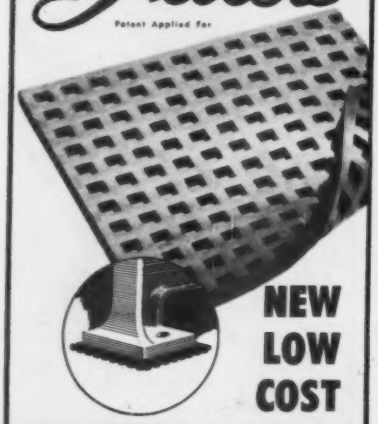
New company, known as Schindler-Reliance Electronics Ltd, pro-

National Tool, Die & Precision Machining Association has elected **John D Dewhurst** (third from left) president. Mr Dewhurst heads the **Arrow Tool Co**, Wethersfield, Conn. Other officers elected are (left to right) **David J Bathgate**, president of **Oval Tool & Die Corp**, Detroit, secretary; **Rolf H Berg** of **Atols Tool & Mold Corp**, Schiller Park, Ill, first vice president; **Fred D Wright**, president of **Fred D Wright Co**, Nashville, Tenn, second vice president; **DeWitt L Bills**, vice president of **World Tool & Engineering Co**, Minneapolis, treasurer; and **Charles R Bender**, executive vice president and executive secretary of NTDPMA

FABCEL

Pads

Patent Applied For



NEW LOW COST MACHINE MOUNTS

Eliminate Anchor Bolts Lag Screws and Cement

FABCEL Pads improve machine performance and reduce maintenance. Their scientifically constructed suction cells anchor machines to the floor . . . Control Vibration, Absorb Impact Shock and Reduce Noise.

FABCEL NEOPRENE PADS ARE *Easy to Install*

Just cut to shape or size required from standard 18" x 18" FABCEL sheets. Slip into position. Then Check the Difference! Check the savings in Time and Money!

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- made by the makers of Fabreeka -

vides a cooperative arrangement for combining the engineering and manufacturing techniques of the Cleveland firm and Schindler & Co Ltd of Ebikon - Lucerne, Europe's largest elevator manufacturer, and a leading producer of electric motors and other industrial equipment. The British licensee is the Electric Construction Co of Wolverhampton, a company with an 80-year history in the electric motor and industrial drives field.

Schindler-Reliance is already producing Reliance-designed electronic controls and drive systems for the European market; construction of a $1 million research center and plant is scheduled to begin by the end of this month and will be completed in about a year.

Reliance, which pioneered the development of industrial electronic motor control systems for variable speed drives, is currently working on more sophisticated control systems employing semiconductors in place of electronic tubes. One such product is Cardpak, a unit assembly of new modular building blocks using printed circuits. Another control system is capable of synchronizing the speed of 50 motors in a continuous processing operation so that precise tension is maintained throughout the operation. These and other Reliance-developed systems will be produced, sold, and serviced by the Swiss company throughout the Common Market area as well as in the West European nations that are not part of the Inner Six.

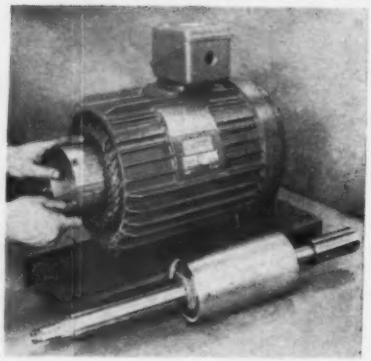
Lahr Machine Acquired By Warner & Swasey

Lahr Machine & Tool Corp, Toledo, Ohio, designer and manufacturer of special purpose deep hole and gun drilling machines, has been purchased for cash by Warner & Swasey Co of Cleveland. To be known as the Lahr Machine Division of W&S, it will continue to operate in Toledo under its existing management.

The machine tools manufactured by Lahr, most of which feature numerical controls, are designed for handling of troublesome drilling tasks on large area work.

New Name for PMI

The Pressed Metal Institute, national association of metal stampers and their suppliers of material and equipment, will now be known as the American Metal Stamping Association. Headquarters are in Cleveland.



Canned Motor Pump Wins Lincoln Foundation Welding Design Contest

Annual savings of $38,440 through welding design of a motor pump won the first prize of $3,000 in the Machines Division for G H Lynn, manufacturing specialist and I John Niemkiewicz, design engineer, both of Allis-Chalmers Mfg Co plant in Cincinnati, Ohio.

The winning design called for arc welding to solve manufacturing problems caused by the need to use various materials of construction, hold close tolerances, control distortion and join thin to thick sections. The new welded design of the canned rotor assembly in addition to saving 34.9 percent over the old design, is more reliable and simpler to manufacture.

Second award in the Machines Division went to Richard W Stanley, senior design engineer of Rayon Mfg Corp, Cleveland, Ohio, for his paper, "Arc Welded Textile Machine." Welded design of the textile machine resulted in clean lines and cost saving of 29% over the former cast design.

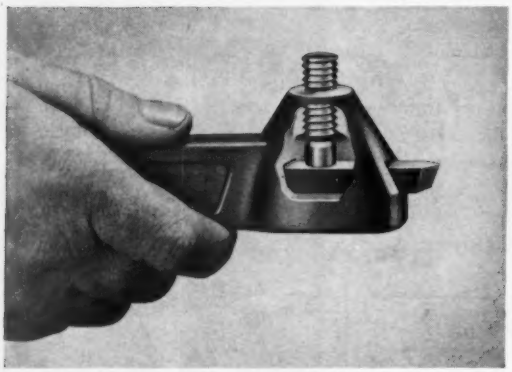
Robert M Johnson, project engineer, Roots-Connersville Blower, a division of Dresser Industries, Inc, Connersville, Ind won third award of $1,000 for his paper describing how submerged arc welding solved problems brought on by increased pressure ratings in gas meters. Arc welded steel construction was used when pressure ratings jumped from 125 psig, where cast iron was adequate, to 600 psig.

Another 35 contributors received awards ranging from $500 to $1,000 for papers in the Machines Division, and 38 contestants shared awards in the Structures Division. The awards were made by the James F Lincoln Arc Welding Foundation of Cleveland, Ohio, as part of its annual $25,000 contest in improvement of the design of machines and structures through the use of arc welded steel. •

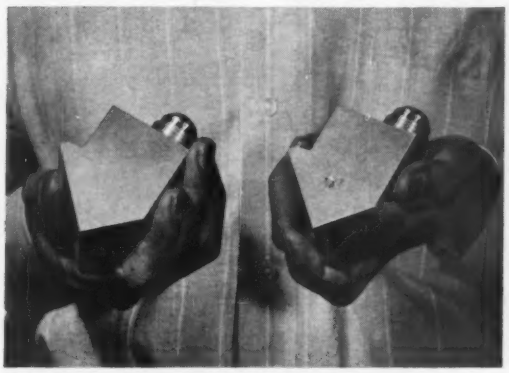
Practical Tooling Tips

No. 1 of a Series

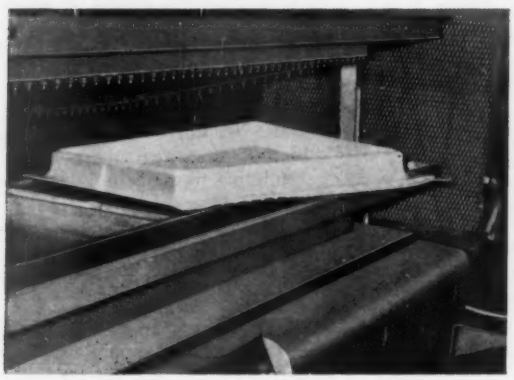
Everyday more and more shops are using standard Vlier Tooling Accessories in place of custom-made devices for both tooling and original equipment applications. The precision construction, product uniformity and quick availability of these simple time-savers have made them tool room favorites. Why don't you start saving from their use?



TO GET GREATER TOOL BIT RIGIDITY replace the tool holder screw with a Vlier Swivel-Pad® Clamp. The large, flat pad face provides many times more clamping area. Bits can be held tighter, reducing chatter and vibration. Small, narrow cut-off blades, multipoint tools, even stub ends can be rigidly held. Unique ball joint construction gives smooth angle adjustment in all directions.



EASY WAY TO STOP MARRING surface of part held in fixture. The part on the left was securely held in the fixture with a Vlier Swivel-Pad® Clamp. The scrapped part on the right was held with an ordinary set screw. With the Vlier Swivel-Pad® Clamp the pad stops at first contact with the part; screw torque is absorbed by a ball, preventing damage to the part. This exclusive ball joint construction also provides adjustment to off-angle surfaces.



THE RIGHT AMOUNT OF END PRESSURE AND NO MORE is what this spring plunger application calls for. More than 150 Vlier Spring Plungers are used to hold a plastic sheet in position during the forming operation of a plastic refrigerator door liner. Spring Plungers provide just the right amount of pressure to produce a perfect liner.

FREE IDEA BOOKLET— 16 pages crammed with photographs showing how others have profited by designing standard Vlier parts into their products. Your Vlier distributor will be pleased to give you a copy, or if you prefer, write directly to us.

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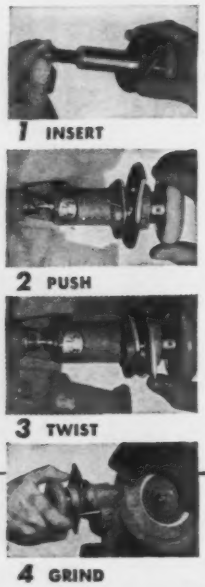
PRECISION DRILL GRINDING:

Black Diamond* does it better, faster, easier



Black Diamond Grinders are saving drills . . . saving labor costs . . . saving production time in actually thousands of shops. Reason #1: no drill grinder made does the job so fast and so easily . . . and there's absolutely no skill required! Anybody — yes anybody — can restore like-new sharpness to dull drills with absolute accuracy in just ten seconds!

If your drills, your time and your money are worth saving, you ought to get the facts. They're yours for the asking. **Write exclusive distributor:**

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*Black Diamond Saw & Machine Works, Inc.

Natick, Mass.–Manufacturers of Black Diamond and Worcester Drill Grinders.

Black Diamond Drill Grinders: For #70 drills up to ¾"

Worcester Drill Grinders: For ⅛" drills up to 2½"

CIRCLE 355 READER SERVICE CARD

The Accurate Way to test MICRO and MACRO hardness

Wilson TUKON hardness tester

Wilson TUKON testers make and measure extremely shallow indentations. They are used, for example, by manufacturers of watches, hairsprings, needles and jewels. In laboratories, TUKON instruments test individual crystals or microscopic particles. On any job, they provide these important advantages:

Accuracy—Precision-built TUKON testers give consistently correct results. Loads are applied without friction or impact—Bausch & Lomb optical equipment is standard—vibration is closely controlled.

Long life—Simple design, rugged construction make TUKON testers as durable as a machine tool.

Easy operation—Even an unskilled operator can get perfect readings after a short training period.

Supplied complete—Special accessories available for various sizes and shapes.

A complete line of Wilson Rockwell instruments is available, including semi and fully automatic models.

For Perfect Readings Every Time, use Wilson "Brale" Diamond Penetrators for Rockwell testers, and Knoop and 136 Square Base Pyramid Indenters for microhardness testing.

Write for details—Ask for Catalog RT-58. It gives complete information on the TUKON tester as well as on the full line of Wilson Rockwell hardness testers.

WILSON "ROCKWELL" HARDNESS TESTERS

Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.
230-B Park Avenue, New York 17, New York

ACCO

NAMES IN THE NEWS

of the Cleveland Works of the Jet Division. He moves up from the post of manager in charge of airfoils manufacturing.

Seneca Falls Machine Co, Seneca Falls, NY, has promoted **Arthur S Dinsmore** (top) from assistant to chief engineer. **Russell M Wheeler** has been named manager of production and quality control

Morris Machine Works, Baldwinsville, NY, manufacturer of centrifugal pumps, has elected **Carleton M Sloat** a vice president. Formerly works manager, he will continue to be responsible for all phases of manufacturing.

Kollsman Instrument Corp, Elmhurst, NY, has named **R D Rhodes** director of industrial engineering. He comes to the company from the Aircraft and Missiles Division of Fairchild Stratos Corp, Hagerstown, Md, where he was chief industrial engineer.

Wilkerson Corp, Englewood, Colo, producer of filters, regulators, and lubricators, has named **John D Nosler** manager of manufacturing. Prior to joining the firm, Mr Nosler was senior manufacturing engineer at the Martin Co.

"I don't know who you are.

I don't know your company.

I don't know your company's product.

I don't know what your company stands for.

I don't know your company's customers.

I don't know your company's record.

I don't know your company's reputation.

Now—what was it you wanted to sell me?"

MORAL:
Sales start before your salesman calls—with business publication advertising.

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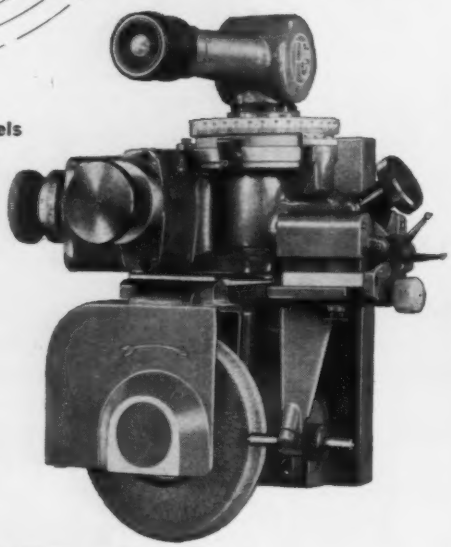
NOW—
form dress grinding wheels in half the time— and far more precisely!



New OPTIDRESS forms wheels under optical control, permanently mounts to surface grinders and tool and cutter grinders.

Dress in one continuous motion a radius and two tangent angles.

Intricate profiles formed without templates, production speeded on limited runs.

Microscope-controlled diamond assures accurate settings, perfect blending from radius to tangent and inspection of dressed wheel.

Permanently attached to the machine—always ready for specials —machine set-up not required between grinding and re-dressing.

Write today for detailed information on OPTIDRESS and other new Parker-Hartford optical equipment that will simplify form grinding on your present machine.

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OPTICAL DIVISION

650 Franklin Avenue, Hartford, Conn.

CIRCLE 358 READER SERVICE CARD

DO YOU HAVE THE ENGINEER'S GUIDE TO BLIND RIVETING PRACTICES?

Installed cost of a blind rivet is ofttimes lower than over fastening devices. Here is a 8-page analysis and compendium of blind riveting practices and applications. The reprint is priced at 35¢ and may be secured from

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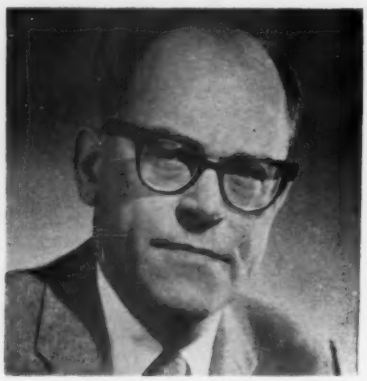
330 West 42nd Street, New York 36, N. Y.

NAMES IN THE NEWS

Chrysler Corp has elected **Alan G Loofbourrow** a vice president of the company. He is director of engineering. Three new plant managers have been named in the Stamping Group. **J B Kendall** has been transferred from the Conant Stamping facility to the Eight Mile plant; **D A Milton,** formerly manager at Eight Mile, will now manage the Outer Drive plant; and **W T Hanlon** moves from the Outer Drive to the Vernor North plant.

Douglas Aircraft Co, Santa Monica, Calif, has appointed the following divisional vice presidents: **W L Whittier,** vice president-deputy general manager, Aircraft; **Leo J Devlin,** vice president-engineering and product development, Aircraft; **R L Johnson,** vice president-product development, Missile & Space Systems; and **J R Allen,** vice president-general manager, Tulsa Division.



Foote Bros Gear & Machine Corp, Chicago, has named **G P Lavold** gear products sales manager. He was formerly in charge of gear and reducer application engineering

Brown & Sharpe Manufacturing Co, Providence, RI, has appointed **Henry A Szostek** sales manager of the Cutting Tool Division. He has most recently been in charge of the combined north central and eastern sales districts

Gleason Works, Rochester, NY, has named **Harry J Hart** export manager. He has been associated with the firm since 1941

Jered Industries Inc, Birmingham, Mich, producer of automated equipment, has promoted **W E Cameron** from chief equipment engineer to vice president, engineering

National Castings Co, Cleveland, has appointed **Carlisle R Slater** vice president, operations and engineering of the Transportation Products Division. **Edward O Spahr** succeeds Mr Slater as works manager at Melrose Park. Mr Spahr was formerly general superintendent of the Sharon Works.

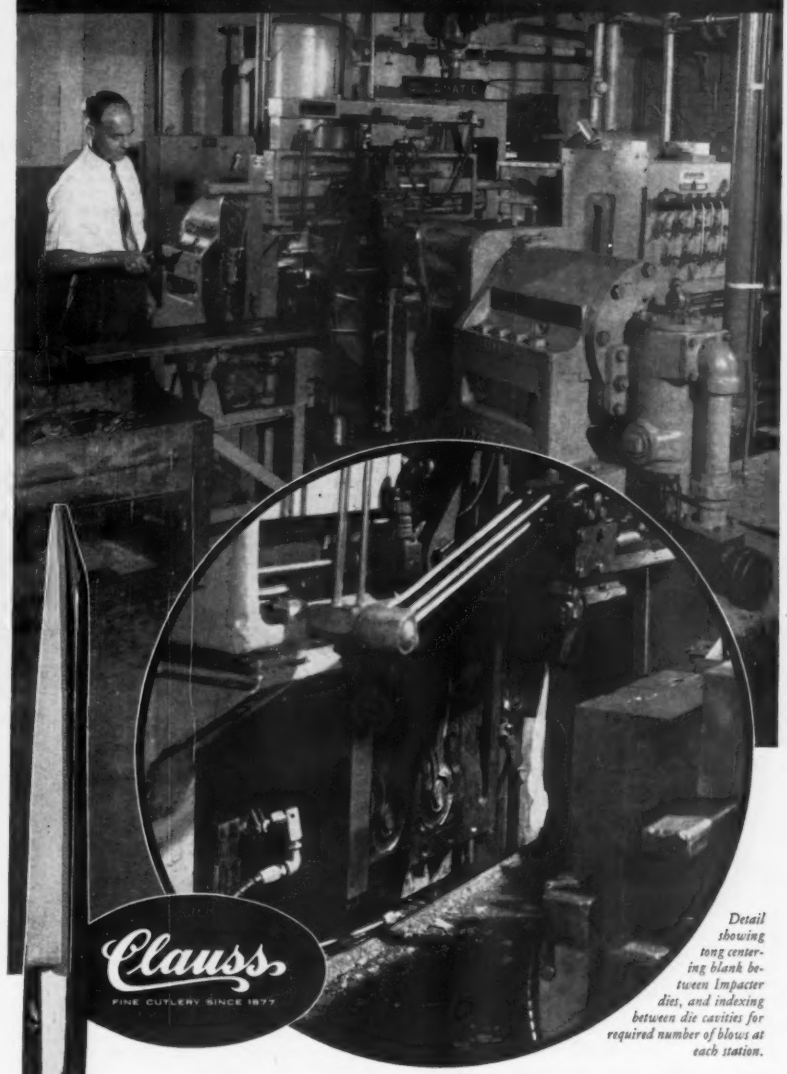
Bunting Brass & Bronze Co has named **Charles W Esch Jr** general superintendent of the Toledo plant. He was formerly associated with Randall Graphite Bearings of Lima, Ohio as chief engineer.

OBITUARIES

Walter M Fairbairn, chairman of the board and former president of **Barnes Drill Co,** Rockford, Ill, died Oct 5.

Harry Woodhead, 72, who headed **Convair** from 1943 to 1948, died Oct 30. Prior to his death he was assistant to the president of **Douglas Aircraft Corp.** •

"The Model 'C' Impacter achieves new peaks of production speed and efficiency for Clauss"



Detail showing tong centering blank between Impacter diet, and indexing between die cavities for required number of blows at each station.

Scissor forgings produced automatically on the Impacter ..faster, better, more uniform

Clauss Cutlery Company, of Fremont, Ohio, famous manufacturer of scissors, shears and snips, is achieving remarkable results with the Cecomatic Forging Process, incorporating the Model "C" Impacter.

Better quality forgings are produced faster, with reduced scrap, and less stock required.

Dies last longer, scaling is reduced and parts dimensions vary less, greatly reducing mismatch of mating parts, according to R. W. Van Hook, Vice President, Clauss Cutlery Co.

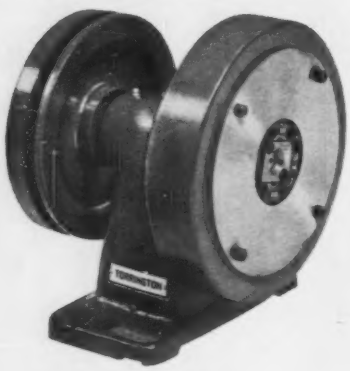
Write for details and a copy of Bulletin 110-L-1, "Cecomatic Process for the Jobbing Type Production of Drop Forgings."

CHAMBERSBURG ENGINEERING COMPANY • CHAMBERSBURG, PA.

CHAMBERSBURG

THE FRANKLIN INSTITUTE'S 1961 LONGSTRETH MEDAL "FOR INVENTIONS OF HIGH ORDER" WAS AWARDED THE DESIGNERS OF THE IMPACTER

HOW TO SHAPE 1000-2700 SMALL PARTS AN HOUR— WITH NO METAL WASTE!



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enable you to do a tremendous variety of forming and assembly operations at high speed and low cost...

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Torrington offers a complete line of swaging machines — large and small. Our engineers can help you select the right machines for your particular needs. Write us.

largest maker and user of rotary swaging machines

ROTARY SWAGING MACHINES

THE TORRINGTON COMPANY

Torrington, Connecticut

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 HEAVY-DUTY RADIAL DRILLING MACHINE—*Giddings & Lewis Machine Tool Co, Fond du Lac, Wis.* 20-page catalog R-40 covers Bickford Chipmaster machines available with 13, 15, 17, and 19-in. columns and 4, 5, 6, 7, and 8-ft arms. All models are available with standard manual or with optional partial or full preselection of 36 speeds and 18 power feeds. Standard features described include new four-bearing spindle design; extra-long spindle sleeve bearing; rugged, compact speed train with herringbone final drive gear; and centralized electrical controls.

2 ABRASIVE BELT GRINDERS — *Hammond Machinery Builders Inc, 1613 Douglas Ave, Kalamazoo, Mich.* 20-page catalog ABG-300 provides comprehensive data on application and use of the grinders plus specifications, photos and cutaway drawings illustrating construction and design features of each model. Also described and pictured are features and advantages of the firm's line of general purpose grinders, carbide tool grinders, and polishing lathes up to 3 hp.

3 DIAMOND TOOL LATHES — *Milo Manufacturing Co, Engineering Dept, 259 N Broad St, Elizabeth, NJ.* 12-page bulletin illustrates and describes precision units designed for production of turned surfaces of high quality of finish, especially on non-ferrous metals. Applications included together with data on surface finish, flatness, dimensional accuracy, correctness of cylinder form.

TOOLS AND ACCESSORIES

4 TESTING AND BALANCING — *Tinius Olsen Testing Machine Co, Easton Rd, Willow Grove, Pa.* 8-page brochure, "Tinius Talks Vol 13 No. 2" pictures and describes latest developments in equipment. Includes details on the 1,200,000-lb Super L universal testing machine; new sheet metal ductility tester with XY recorder for plotting load vs depth of cup; high-speed automatic wire tester; new strain instrumentation, including a separable extensometer; and the latest Air-O-Brinell air-operated metal hardness tester.

5 CUTTING TOOLS — *DoAll Co, Des Plaines, Ill.* 300-page catalog 62 is a hard-bound volume that lists complete line (more than 30,000 items) of cutting tools, inspection equipment, abrasives, cutting fluids, tool and die steels, OEM products, and machine tools—grouped in 12 sections. In the full index that follows the quick index, over 2400 separate listings are cross-referenced. Operating data is included wherever it is helpful for proper tool selection.

6 MINIATURE SOLID CARBIDE TOOLS—*Atrax Co, Day St, Newington 11, Conn.* 8-page brochure gives application information and prices on small, very small, and miniature precision ground solid carbide tools recommended for electronics circuit board and instrumentation applications. Includes Micro-Drills in wire sizes No. 40 through 80; miniature end mills, stub routers, hole grinding burs, midget burs and micro-reamers—solid carbide throughout.

● SLIDE-RULE TOOL SELECTOR — *Wesson Corp, 1220 Woodward Heights Blvd, Ferndale 20, Mich.* Circular slide-rule tool selector covers typical special carbide tools only, for milling, turning, and boring. Does not include standards. Purpose of the selector is to show how processing can be speeded and simplified by combining operations normally requiring multiple setups through the use, on a single machine, of multi-operation special tooling of relatively simple design. Request direct on company letterhead.

7 GRANITE SURFACE PLATES — *A Ottavino Co, 1026 Brooklyn Ave, Brooklyn 3, NY.* 4-page bulletin 101 provides information on granite characteristics to be considered when selecting surface plates. Contains a chart covering granite color, abrasive resistance, flexural strength, economy, and size. Includes price list on Ottavino gray, pink, and black granite surface plates, giving sizes in inches; thickness; ledges; overall accuracy; and shipping weight.

8 OPTICAL AIDS—*Edmund Scientific Co, Barrington, NJ.* 160-page catalog has information on products for production, lab work, engineering and quality control including measuring magnifiers, pocket comparators, illuminators, projection sets, microscopes, prisms, wedges, hand and pocket spectroscopes.

9 BORING TOOLS—*Bokum Tool Co, 14775 Wildemere Ave, Detroit 38, Mich.* 4-page condensed catalog 6110 illustrates and provides information on complete line of tools specially designed for boring, recessing, and threading operations. Includes super high-speed steel, carbide-tipped and solid tungsten carbide boring tools; jig boring tool set; short-neck boring tools; permanent or non-adjustable toolholders; Bokumicro Dial boring head; Rapidor roughing and cutoff tools; swing boring tool holders; Bokumatic recess toolholders; and standard HSS grooving tools.

10 CUTTING AND GRINDING LUBRICANT—*D A Stuart Oil Ltd, 2727 S Troy St Chicago 23, Ill.* Folder on new Solvol 900 water-mix product includes job-application studies, cutting characteristics and advantages.

HEAT TREATING AND WELDING

11 GEAR-DRIVEN WELDING POSITIONER—*Aronson Machine Co, Arcade, NY.* 13-page booklet, "Positioneering (Section 9)," discusses the 90° forward and 45° rearward tilting type of welding positioner. Engineering details and specifications given on models from 40,000 to 350,000-lb capacities.

12 BRAZING ALLOY CHART FOR STAINLESS — *Handy & Harman, 850 Third Ave, New York 22, NY.* Selection chart containing data on the 300 and 400 series, 17-7PH, PH 15-7MO and Am-350 stainless steels, lists the brazing alloys, fluxes, and atmospheres most suitable for joining these steels. Typical applications are cited; information on compositions, melting and flow points of alloys most commonly used for brazing stainless is included.

13 WELDING ALLOYS — *All-State Welding Alloys Co. 249-55 Ferris Ave, White Plains, NY.* 60-page application manual gives 1000 uses for the firm's specialty alloys for all types of welding, brazing, and soldering of conventional metals. Bronze, copper, stainless, cast iron, magnesium and aluminum joining are among the applications listed. First 25 pages of the manual detail examples of what these alloys have done in solving difficult joining problems. Analysis of costs, time, and operating procedures are included.

14 INFRA-RED OVEN — *Infra Red Systems Inc, 240 Route 23, Riverdale, NJ.* Illustrated bulletin 117 illustrates and describes a modular muffle oven that is split longitudinally and hinged to provide for easy inserting and removing of work. Unit offers high-speed heating in the curing of insulation on wire and cable; the heat-treating of rods, bar tubing, cable, extrusions, and long symmetrical shapes. Specifications and a table of sizes are included.

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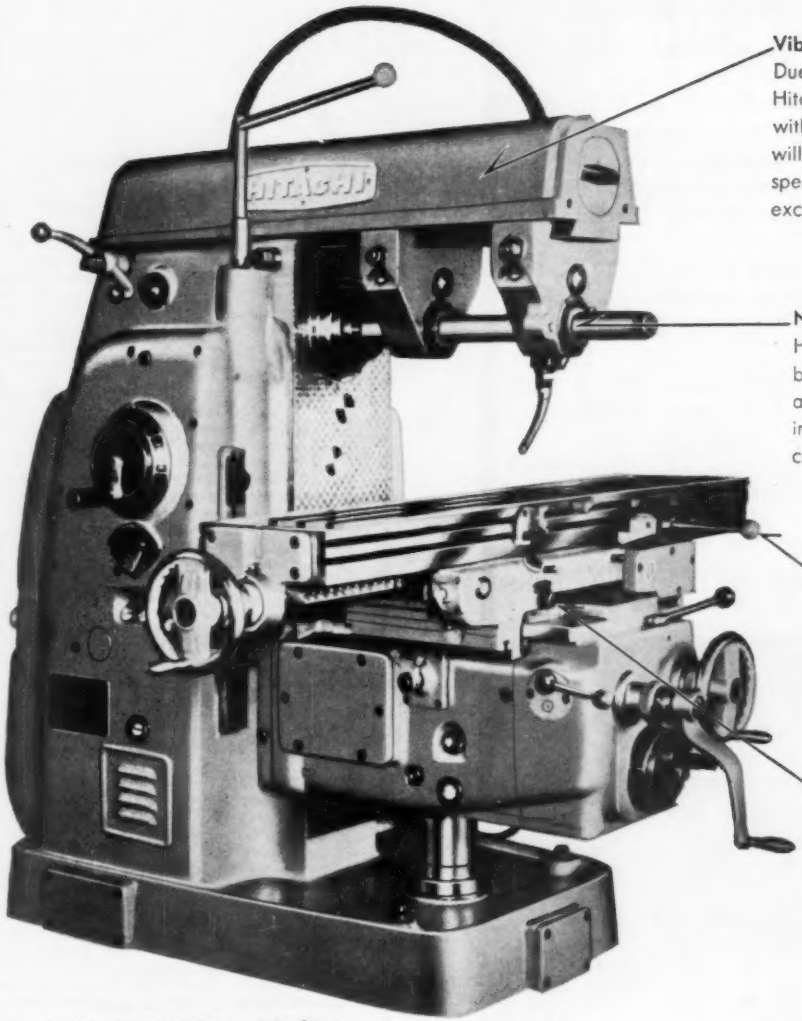
NO. 2 ML MILLING MACHINES



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Due to a vibration damping device of Hitachi's exclusive design contained within the over-arm, minimum vibration will be set up even during higher speeds and feeds operation, so that an excellent finished surface is obtained.

New-Type Arbor Support Bearing
Hitachi's unique super precision-type bearing, a combination of plain metal and needle bearing, is incorporated into the machine to enable high speed cutting with high precision results.

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Hitachi's unique Mono-lever Control System makes the operation simple and easy. Table-feeding too can be performed with ease.

Backlash Eliminator of Lead Screw
As the use of two independent nuts eliminates backlash on the table feed screw, smooth down-cutting can be effected.

SPECIFICATIONS :

- 53 1/8″×10 1/16″ Table
- 28″ Longitudinal Traverse
- 16 Table Feeds 1/16″ — 78 3/4″/min.
- 16 Spindle Speeds 25 — 1,500 r.p.m.
- 7.5 h.p. Main Motor

Hitachi, Ltd.
Tokyo Japan

Cable Address : "HITACHY" TOKYO

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SUMITOMO ELECTRIC INDUSTRIES, LTD.

Osaka—Tokyo, Japan

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

15 SPOT WELDER—*Birdsell Products, 350 N Halstead, Pasadena, Calif.* Bulletin 130 describes 4.6 kva, 220 or 440-v bench model unit with capacity to spot weld from 16 gage to 30 gage mild steel, CRS, stainless, or galvanized. The 220-v single-phase 50/60-c standard spot welder has a heavy-duty contractor and electronic timer to prevent possibility of burning work; current control with electronic timer settings 3 to 30 c; heat control setting 1 to 5; welding current at tips from 4000 to 7000 amp; squeeze pressure up to 400 lb.

PLANT SERVICE EQUIPMENT

16 VANE PUMPS—*Denison Engineering Division, American Brake Shoe Co, 1160 Dublin Rd, Columbus, Ohio.* 4-page bulletin 200-A on the use and operating characteristics of Denison vane pumps at pressures up to 2500 psi discusses Series TIC and a variety of possible applications in hydraulic circuits. Included are performance and efficiency charts and schematic diagrams. Also provided is a tabulation of typical pump operating characteristics.

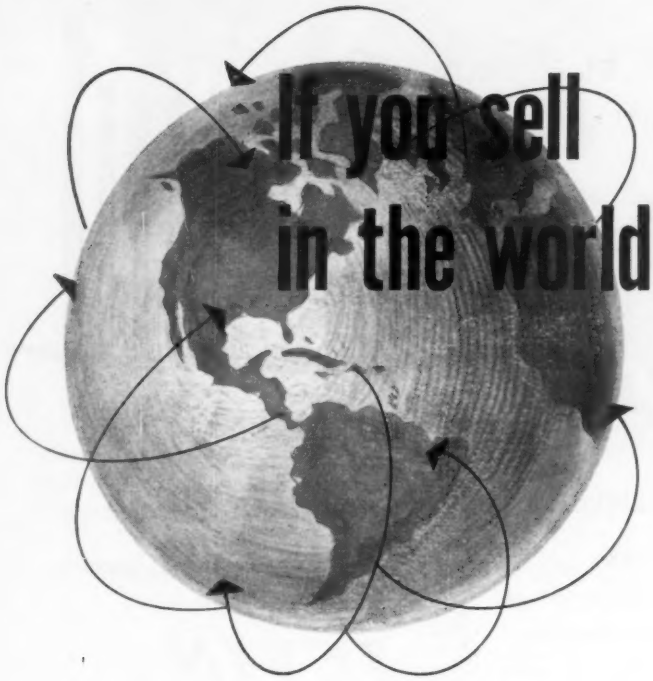
17 MAY-FRAN CHIP-TOTE CONVEYORS—*May-Fran Manufacturing Co, 1710 Clarkstone Rd, Cleveland 12, Ohio.* 4-page illustrated bulletin MF 650-A provides design and application data on a complete series of off-the-shelf, hinged-steel belt chip removal conveyors that will fit all machine tools. Described and illustrated is the Chip-Tote conveyor that can be assembled from stock components to fit any machine tool regardless of space or load requirements. Installations can be made on the machine, above floor level, flush, or below floor level for continuous removal of chips, turnings, and borings. Engineering data section gives complete specifications on the conveyor, 2½-in. pitch hinged-steel belting, and the heavy-duty motor and constant or variable speed drives.

PARTS AND MATERIALS

18 COPPER-SULFUR ALLOY—*American Metal Climax Inc, Amco Sales Division, 1270 Avenue of the Americas, New York 20, NY.* 18-page booklet supplements a comprehensive machinability study with data on properties and performance of Amsulf, a high-conductivity, free machining alloy consisting of the company's OFHC brand copper plus 0.3% high purity sulfur. Containing drawings, tables, and other data, the report shows that Amsulf offers a machinability rating of 85, hot and cold workability that approximates unalloyed OFHC brand copper, and an electrical conductivity of 96% IACS.

19 ALLOYS FOR CENTRIFUGAL CASTINGS — *Wisconsin Centrifugal Foundry, 905 E St Paul Ave, Waukesha, Wis.* The 40 non-ferrous alloys most frequently specified for centrifugal castings are described in a master chart. Covers aluminum bronze, gear bronze, bearing bronze, and manganese bronze, nickel, silver, and special alloys. Nominal chemical compositions are presented for each alloy as well as minimum and typical mechanical properties including calculations for Brinell hardness, elongation, tensile and yield strength.

20 HIGH-IMPACT ACRYLIC MOLDING POWDER—*Rohm & Haas Co, Plastics Dept, Washington Square, Philadelphia 5, Pa.* 4-page technical brochure describes chemical and physical properties of Implex R, a new grade of molding powder said to offer double the highest impact strength previously available in any member of the Implex family. ●



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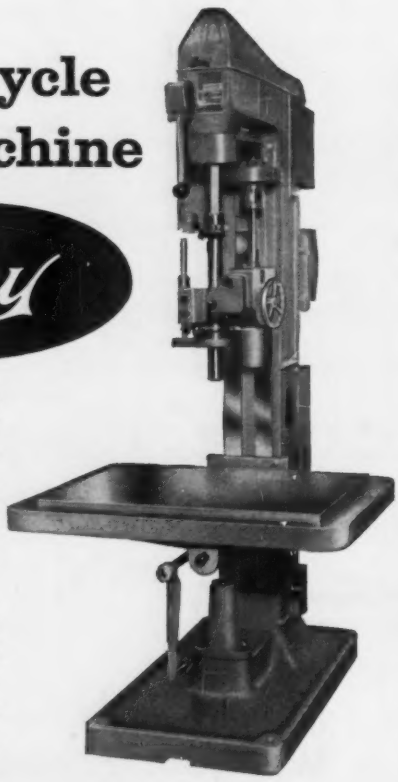

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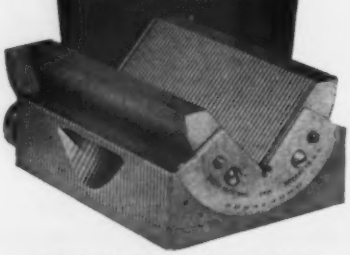

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milling boring and combined machine

Universality, productivity and easy handling....

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MITSUBISHI ZOSEN (Mitsubishi Shipbuilding & Engineering Company) manufacture and distribute the FA 140/95 type (dia. of spindle 140 mm for milling, and 95 mm for boring) of this universally-known machine, licensed by INNOCENTI S.G. of Milano.

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NICHOLS model 6-SA is:

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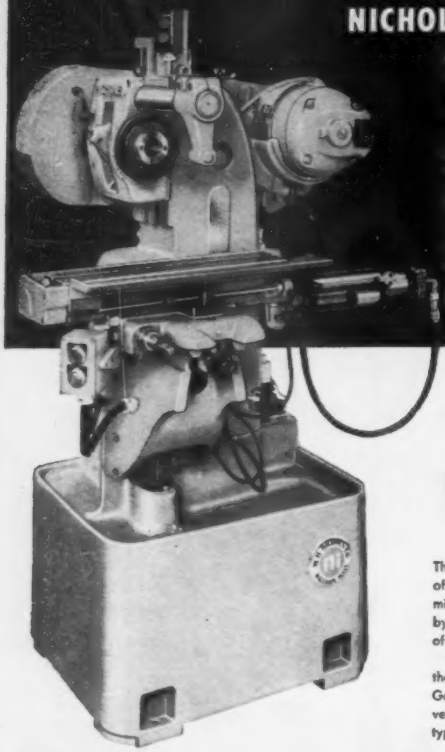

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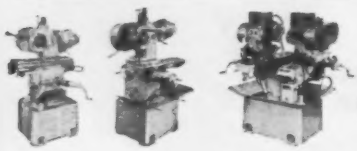

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ACTUAL SIZE

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- **Ground all over for extremely fine dimensional control**

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0	1/8"	1/32"	1/16"	1¼"
00	5/64"	.025"	3/64"	7/8"
000	1/16"	.016"	.030"	7/8"

60° included angle standard.
*Specials as small as .005" are available.

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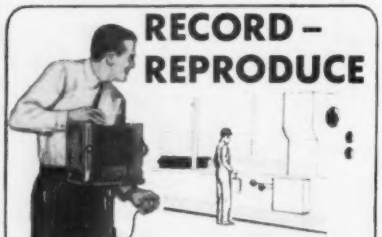

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Listed below are used surplus new and rebuilt machine tools or services as advertised in this section.

The numbers after the advertiser's name indicates the products or services offered by the advertiser.

3. Automatics
7. Boring Mills
8. Broaching Machines
14. Cutting Off Machines
17. Drilling & Reaming Machines
22. Forging Equipment
25. Gear Cutting Machines
26. Grinding Machines
28. Honing & Lapping Machines
31. Lathes
37. Milling Machines
42. Planers
45. Press Brakes
46. Presses
51. Roll Formers
53. Saws
56. Shapers
57. Shears
60. Steel Mill Equipment
63. Threading & Tapping Machines
66. Welding Equipment

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Stevens Machinery, Lee	164	7, 17, 63
Visi-Trol Engineering Co.	163	37

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11/27/61

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5HM K&T Vert. Mill sliding head 1945.
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OFFERS "GUARANTEED" MONA MEMBER MACHINE TOOLS—

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*Indicates 1940+ Model **Indicates 1950+

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**2AC Warner Swasey Autom Chucker S/N 1,643,456 (1957)
**16S Gorton Swiss ½" cap, Pneum Bar feed, 3 Spdl Attch (1953)
**0G Brown Sharpe ⅝" cap, V. Slide, Slotter, 2" Turret Cap (1952)

BOREMATICS
**22I & 32I Heald Sgl. End. 2 Spdl Excellent
*1212A Excello Dbl End, 4 Spdl 1943 RCG
**3U Stokerunit Dbl. End Dbl. Spdl. #DH-4 Heads
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BORING MILLS
36" King VBM complete
*36" Bullard VTL, Side Head
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*74" Bullard "Cutmaster" VTL Excel. Like Rblt.
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**6 ton—54" Colonial Hydr Ser 13094, Excel.

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*25" No. 282 Barnes 4 MT. Air feed 3 HP
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*4' x 11" Amer. "Hole Wizard" RBG
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**#106 Gleason Gear Generator s/n 32036
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*#00 & #1 Hamilton Hobbers
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*Type 6 Fellows #61 Shaper 35" OD Cap 1950

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*12 x 36 Cinc. Univ. w/Int. Spdl. RBG
**10x24 No. 4BG1 Van Norman 15" Head '55
**30x48 Landis CHW Univ Like New 1952
*#2 Cinc. Centerless, Profile Dresser RBG
*16 x 36 Landis Cyl. w/5" Head
**Wickman Microform (optical) Like New
**180 Sheffield, Multiform (1957) Like New

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**1316R Bryant Hole Face & Int. 28 Spdl (1952)
*109 Bryant Int. New Spdl. (1947) RBG
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16-16 Bryant Chucking 1600 RPM
**#172 Heald 36" Swg. 36" Str. '43 & '50

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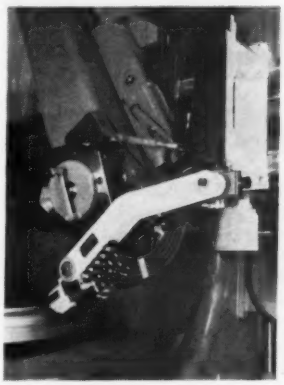

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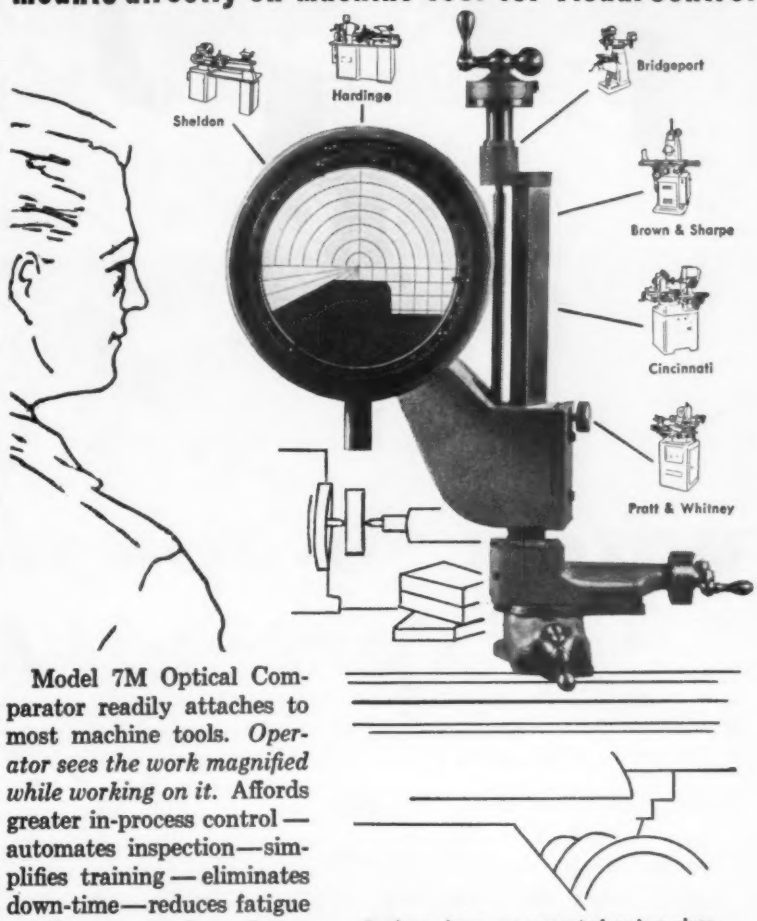

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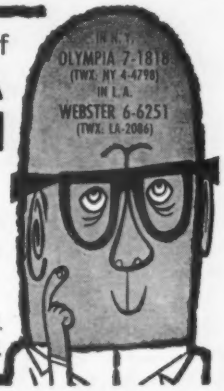

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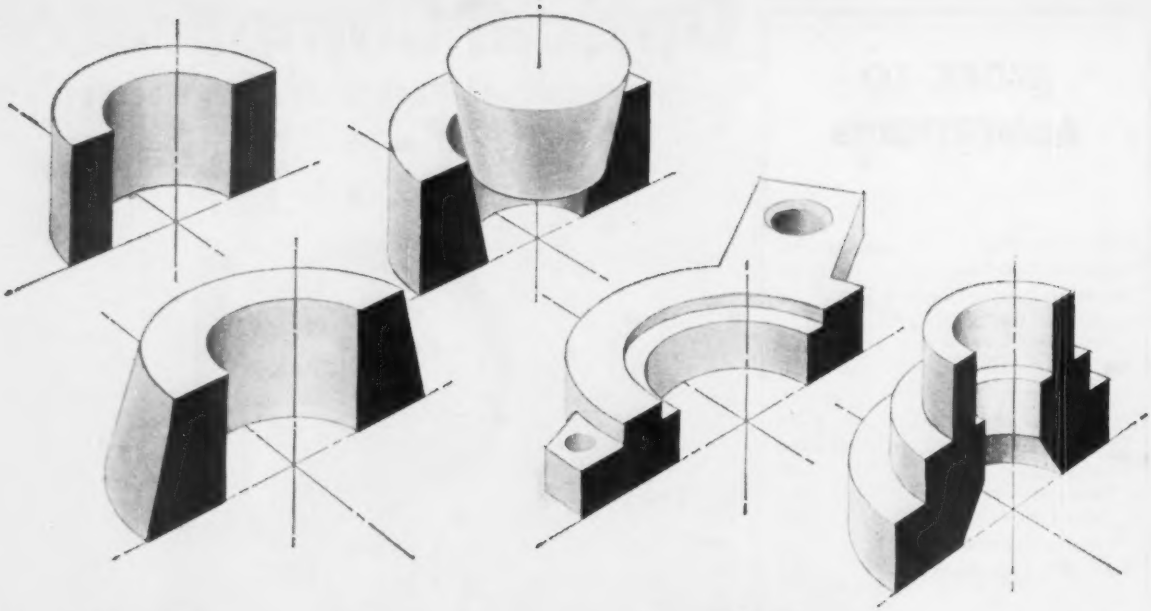

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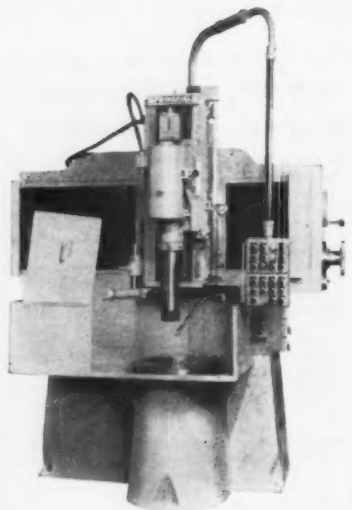

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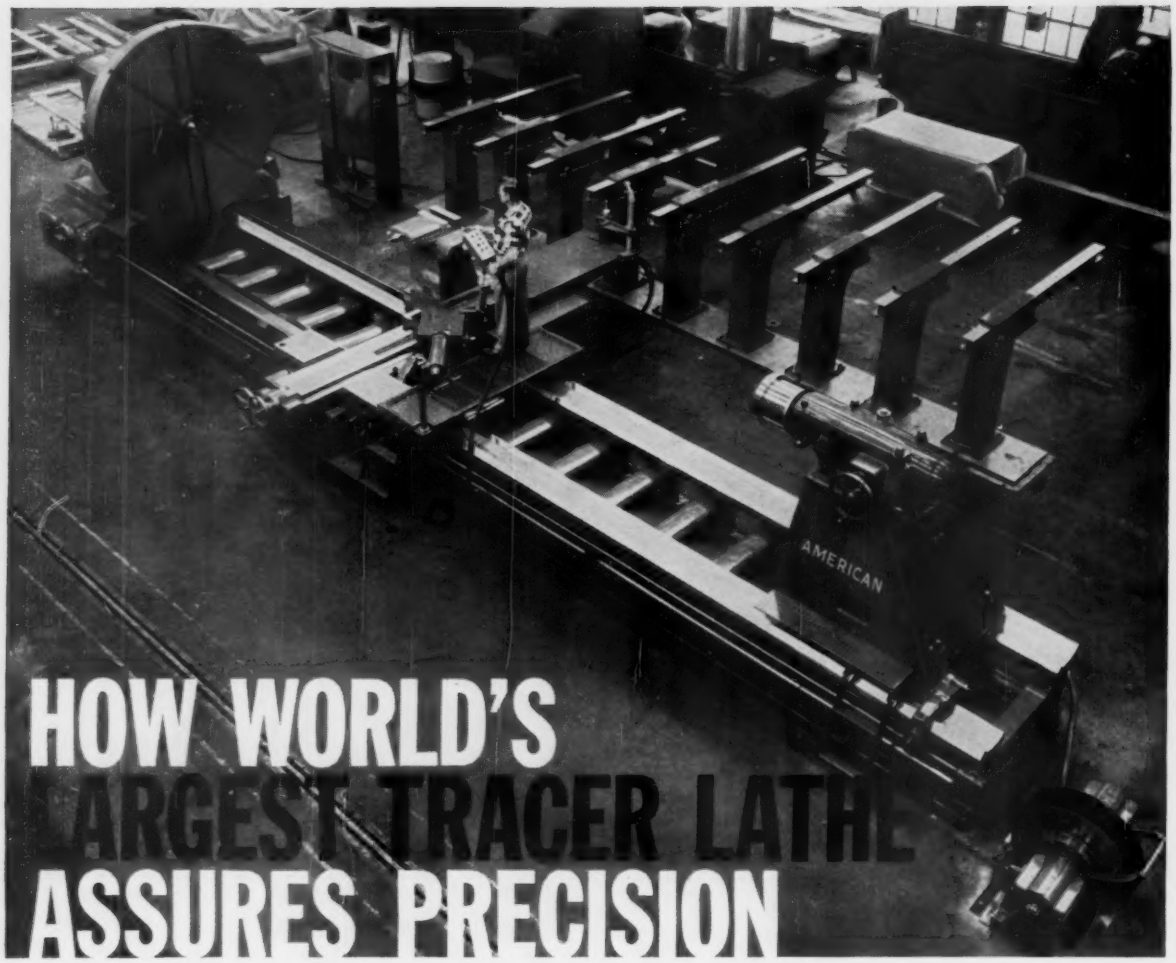

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